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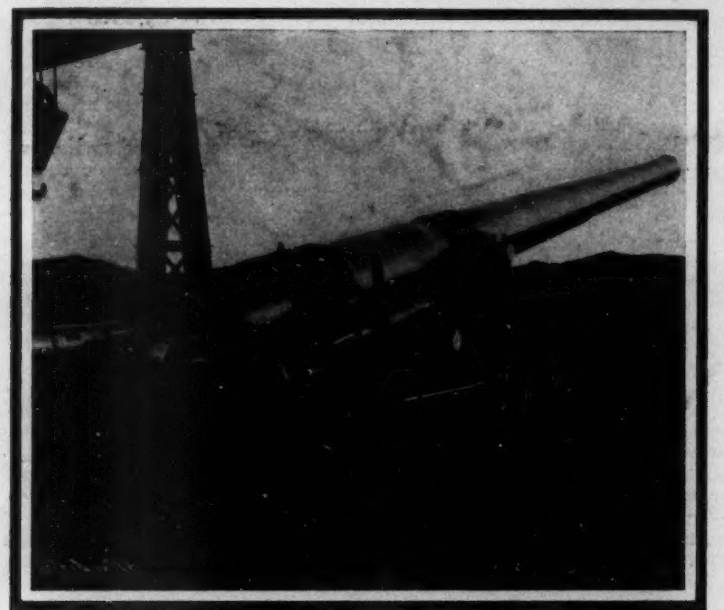

Breech Open, Loading Tray With Charge Swung Round in Position for Loading.

Breech Closed, Loading Tray With Charge Swung Clear of Breech.

Length Over All, 37.2 feet. **Diameter at Breech,** 35 inches. **Diameter at Muzzle,** 18 inches. **Weight of Gun,** 28 tons. **Weight of Projectile,** 380 pounds. **Muzzle Velocity,** 2,900 feet per second. **Muzzle Energy,** 22,160 foot-tons. **Penetration of Wrought Iron at Muzzle,** 37 inches. **Penetration of Krupp Steel at 3,000 Yards Range,** 11 inches. **Rounds Per Minute,** 4.

NOTE: The large 9.2-inch gun, whose length and diameter of chase and muzzle are greatly distorted by the photograph, is on a proving-ground mount. The gun at the extreme right is the new 7.5-inch gun that forms the secondary battery in the "Constitucion" and "Libertad."

THE NEW VICKERS-MAXIM 9.2-INCH, 47-CALIBER, WIRE-WOUND GUN, FOR INTERMEDIATE BATTERY OF BRITISH BATTLESHIPS.—[See page 250.]

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NEW YORK, SATURDAY, MARCH 26, 1904.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

SALT-WATER MAINS FOR FIRE PROTECTION.

The provision of water mains and pumping stations as a protection against fire continues to be the subject of earnest and very intelligent discussion in the daily and scientific press; which in itself is proof that the Baltimore and Rochester fires have served the valuable purpose of opening the eyes of other large cities to the ever-present and stupendous danger which confronts them.

In our recent article urging the installation of a salt-water service, we stated that in this matter, while New York had been talking, other cities such as Philadelphia and Cleveland had been acting, and that the latter were now in possession of a thoroughly efficient equipment. The subsequent quotation of this article in the New York Sun has brought a letter to that paper from an engineer, who draws attention to the fact that in a certain sense New York city and Brooklyn were the pioneers in this type of fire service, inasmuch as the fire-boat system was established in these cities about thirty years ago for water-front fire service. He claims that certain western cities, taking the hint, soon adopted the same method, and that being situated on fresh water, and using fresh water in their fire-boat service, they soon conceived the idea of running iron pipes up the various streets from the water front, to which the fire-boats might be connected when needed. The next step in the development was taken by Philadelphia, which substituted a stationary pumping plant for the fire-boats. The same correspondent points out that the objection to the use of salt water is that there would probably be serious and rapid deterioration of the mains and connections, due to the action of the water on the metal, if it were allowed to remain permanently in the mains.

Among the many articles which have appeared on this subject, we think that the most practical is that of our esteemed contemporary, Engineering News, which proposes that an auxiliary pipe system, of large volume and fitted with the necessary standpipes, should be provided for purposes of fire protection alone, and that these standpipes and mains should be filled with salt water only on the rare occasions when the magnitude of a fire may demand the calling in of an auxiliary source of water supply. Our contemporary proposes to lay a system of high-pressure mains, which would be distributed in respect of its capacity according to the particular requirements of the districts of the city that were served. This system would be provided, at points of special danger, with standpipes and street hydrants for hose connections. At some suitable point on the water front, a powerful pumping station would be located, containing high-pressure pumps, delivering directly into the high-pressure mains. Ordinarily these mains would be connected to the regular city fresh-water supply, and the standpipes, mains, etc., would be filled with fresh water only, thus obviating the dangers of corrosion and general deterioration. For all ordinary fires the pumping station would draw from the regular Croton water supply. But should a fire begin to assume serious proportions, the suction of the station pumps would be cut off from the Croton mains, and connected directly with the salt water of the Hudson or the East River, as the case might be, thereby giving the Fire Department an unlimited supply adequate to any possible magnitude of conflagration. When the fire was subdued, the salt-water connection would be cut off, and the mains would be thoroughly flushed out and filled with fresh water, thus removing all danger of corrosion.

In response to the letter of Mayor McClellan to the Department of Water Supply, Gas, and Electricity, to which we made reference in a recent issue, the department's commissioner has submitted a report of a comprehensive plan for protecting two large areas in Manhattan and Brooklyn. The report is published in the current issue of the SUPPLEMENT, and it will be sufficient to state here that the plan agrees broadly with the provisions above outlined. The first installment in Manhattan would cover the area bounded by Twenty-third Street and Chambers Street, Fourth Avenue and the Bowery, and the North River. It would consist of a system of mains served by three separate pumping stations. Over one thousand hydrants would each supply five three-inch hose at a pressure at the nozzles of 200 pounds to the square inch. There would be two hydrants at each street intersection, thus providing forty such streams to each block. The total supply in emergencies that could be concentrated on a single block would be 1,200,000 gallons per hour. Provision would be made for salt water connections should they prove necessary.

Brooklyn would be similarly served in three districts: Coney Island, the dry goods district, and the lower water front district. The total first cost of the installation would be $3,950,400 if electrical power were used, and $5,293,200 if gas engines were employed. Although the first cost is large, it is small in comparison to the great value of the interests protected.

FUTURE EXTENSION OF THE SUBWAY SYSTEM.

With the present subway lines in such a state of completion that the opening of the system for public use is only a matter of a few months' time at the most, the question of the location and inter-relation of new subways becomes of pressing importance, especially in view of the fact that at least four great corporations, to say nothing of the general public, are vitally interested.

The Inter-Borough Rapid Transit Company, in which is included the old Manhattan Elevated; the Metropolitan Railway Company, which owns practically all the street surface railways in Manhattan and the Bronx; and the New York and New Jersey Company, representing New Jersey trolley interests, have all applied to the Rapid Transit Commission for authority to build subways in this city; while the Brooklyn Rapid Transit Company, although not an applicant for authority to build, is anxious to cross the Williamsburg Bridge and run its cars over a belt line to be built between the two bridges that land in Manhattan, although it prefers that the connection should be made by means of an elevated structure.

It must be exceedingly gratifying to the Rapid Transit Commission to compare the present eagerness on the part of the big transportation companies to build subways with the indifference or distrust with which the rapid transit scheme was regarded by these same interests only four years ago, when bids for the construction of the present subway were solicited. At that time it looked for a while as though the years of labor entailed in arousing public interest, and securing the necessary legislative powers, were to be rendered useless by the reluctance of capital to embark upon an enterprise calling for such a large outlay of money, and necessarily involving many engineering problems of a novel and difficult nature. Great credit is due to the contractor, Mr. Macdonald, and his financial backer, Mr. Belmont, for the courage with which they took hold of this scheme, and the successful issue to which they have carried it. The practicability of building subways, the solution which it has afforded of many questions of construction and cost, and the flattering prospects of profitable operation, have removed subway enterprises from the domain of doubtful ventures to that of practical and very promising investments.

By the middle of the present summer, or at the latest by the early fall, when the term of the present subway contract expires, the new system will be in operation, and it will provide New York city with a four-track road from City Hall Park by way of Elm Street, Fourth Avenue, Forty-second Street, Broadway, and the Boulevard to 104th Street, and two divisions from 104th Street, one running north to the Harlem River and the other extending northeastwardly to a tunnel beneath the Harlem River, and through the Bronx to Bronx Park. The extensions now proposed are as follows: The Inter-Borough Company has applied to the Rapid Transit Company for permission to build an extension of the present subway system below Broadway from Broadway and Forty-second Street, where there is a station on the present subway, to Twenty-third Street, and thence south below Fifth Avenue, West Broadway, and Greenwich Street, to connect with the subway loop, which is now under construction at the Battery as part of the present extension of the subway to Brooklyn. They also seek authority for the construction of a subway and elevated system from the intersection of the present subway and Melrose Avenue in the Bronx, to and beneath the Harlem River, and down Lexington Avenue to a junction with the present subway at Forty-second Street and Fourth Avenue, in front of the Grand Central Station. This is obviously the next natural extension to be made of the present system; seeing that it provides an independent north-and-south line to the west of the present subway below Forty-second Street, and an independent line in the eastern section of the city north of Forty-second Street.

The Metropolitan Street Railway Company, which is one of those interests that was earnestly urged to undertake the construction of the present subway four years ago, are now so thoroughly convinced of the value of the system, that they have filed with the Rapid Transit Board an application for an even more extensive series of lines than that asked for by the Inter-Urban Company. They propose to build a subway from Third Avenue and 138th Street in the Bronx, to extend down Lexington Avenue to Fifteenth Street, then under Union Square to Broadway, down Broadway to Chambers Street, thence eastwardly below Chambers Street to William Street, down William Street to Hanover Square, and then to the Battery, by way of Coenties Slip and South Street; around the Battery outside of the present subway to Greenwich Street; up Greenwich Street, West Broadway, and Hudson Street to Eighth Avenue; and up Eighth Avenue, through the new Pennsylvania tunnel, and eastwardly through Thirty-fourth Street to a junction with its proposed line down Lexington Avenue. There would also be a crosstown connection between the east and west side branches on Thirty-fourth and Chambers Streets. As it is carefully stated in the application that the proposed subway would pass under the existing subway, evidently no connection is contemplated between the two, a defect which, we think, must militate very strongly against the application of the Metropolitan Company in its consideration by the Rapid Transit Commission. On the other hand, the company pledges itself to a system of transfers between its subway lines and the sixteen crosstown surface lines which it controls.

The evidently careful avoidance of the present subway lines, which is manifested in this application, will suggest at once to the public mind that the proposition, if accepted, will be directly opposed to that very unification of the transportation system of this city which is so eminently desirable, as proved by the good results shown in the excellent management by the Metropolitan Company of its own amalgamated street surface lines.

In addition to these very ambitious proposals, the New York and New Jersey Company, which has just completed its first tunnel beneath the river, has applied to the Rapid Transit Commission for authority to extend its tunnel by way of Tenth Street and Sixth Avenue to Herald Square, an extension which would put the large residential districts of New Jersey in direct touch with what is rapidly becoming the principal shopping district of New York city.

The last, and not by any means the least important, subway extension is that proposed by the Rapid Transit Commission itself, which has for its object the provision of a belt line between the termini of the Brooklyn and Williamsburg bridges. This subway would extend from the Brooklyn Bridge by way of Centre Street, Grand Street, and Delancey Street to the terminus of the Williamsburg Bridge. It is sincerely to be hoped that the connection between the two bridges will be made by subway, and not by elevated structure. The elevated structure is preferred by the Brooklyn Rapid Transit Company, for the reason that the Brooklyn Rapid Transit Company's cars are not suited, because of their lack of fireproof provision, for subway travel. If a subway is built, it would be necessary for the company to provide an entirely new equipment of cars, and this, in their present condition, they are utterly incapable of doing. To build an elevated structure between these points would add a further disfigurement to the city and would be a step backward from modern, up-to-date methods. Perhaps the best way out of the dilemma would be to build a subway between the bridges, and operate it as a separate system, providing loops at the Manhattan end of the Williamsburg Bridge for the return of the Brooklyn cars. This would serve until the advent of the day, which is most certainly coming, when the whole of the transportation system in Greater New York, elevated, surface, and subway, in Manhattan, the Bronx, and Queens, will be unified in one system, with a single five-cent fare between all points.

A FLORAL MAP OF THE UNITED STATES AT THE ST. LOUIS EXPOSITION.

The exhibit of the Bureau of Plant Industry of the United States at the St. Louis Exposition will be one of the most interesting exhibits at the Fair. Work has already been commenced upon the making of the monster map of the United States, to form a greater portion of the exhibit. Mr. D. A. Brodie, an expert in the employ of the Plant Department, is superintending the work of laying out the map, though the United States government board appointed by Congress to represent the Federal government at the Exposition will have charge of the appropriation of $5,000. The map will cover six acres, and each State is to be outlined by a cinder path. The entire area has already been underlaid with wooden drains, plowed deep and planted in cow-peas as fertilizers. In each State reservation will be shown plants grown in that State. Where the climatic conditions of St. Louis forbid the growing of plants out of doors, they will be grown under glass. Cotton, tobacco, and sugar cane are to be shown in the Southern States, orange and pineapple in Florida, and corn and wheat in the Middle States. No attempt

will be made to show the principal waterways of the United States. The waste places on the margin of the map, resulting from irregular coast lines, will be used for plant exhibits of various kinds, showing plants grown around the world. Men in the employ of the Bureau of Plant Industry are now scouring the world in search of grasses and plants to be shown to visitors at the Exposition. One patch of ground is to be devoted to cereals, another to poisonous plants, another to fiber, and still another to seed production, grasses, plant breeding, etc. A school of gardening will also be a portion of this exhibit. School children living in St. Louis will attend to a model school garden to be furnished by the government. Prizes are to be awarded to the most apt pupil at this school. School gardens are now becoming more and more popular. The map is located on a sloping hill, and adjoins the agricultural and horticultural exhibits and buildings. It may be seen from any portion of the main exposition grounds, and will be one of the instructive and beauty spots of the Fair.

BORINGS ON A CORAL REEF.

One of the most complete and important contributions to the study of coral reefs and their mode of formation that has so far appeared, even if we bear in mind Prof. Alexander Agassiz's recent work "The Coral Reefs of the Tropical Pacific" (Memoirs, Museum of Comparative Zoology, Harvard College, 1903), may be seen in a monograph just issued by the Royal Society of London, entitled "The Atoll of Funafuti: Borings Into a Coral Reef and the Results."

The project for the investigation of a coral reef with the object of elucidating its structure, originated at the Nottingham meeting of the British Association, held in 1893. At that gathering Prof. W. J. Sollas was successful in promoting a committee, charged to consider whether an exploring expedition was feasible; in the end it was decided to go forward with such an undertaking, and eventually the Royal Society took over the necessary arrangements.

After many meetings and consultations, it was decided to select Funafuti, an island in the Pacific Ocean, as the site for inquiry, the primary aim being the bringing up of a core of rock in order that the composition of the reef might be determined from zoological and chemical standpoints. Actual operations at this ring-shaped spot of land were begun as long ago as 1896, and they continued until 1898.

The well-known hypothesis of Darwin respecting the development of coral reefs in their several forms, although at one time regarded as a truth in geology, is no longer tenable in its entirety, a result largely due to the later observations of Agassiz and Murray. Darwin, himself, however, earnestly desired a fuller examination, *in situ*, than had been at all practicable in his own day, and in fact went so far as to express his conviction (in a letter to Agassiz in 1881) that nothing of a really satisfactory nature could be brought forward as contributory evidence until a boring was made in one or other of the Pacific and Indian atolls, and a core obtained down to a depth of at least 500 or 600 feet. That hoped-for consummation has, however, been over-achieved, since the boring at Funafuti was carried down to a limit of 1,114 feet.

Three expeditions were made before this could be accomplished. The first attempt was made in 1896 with Prof. Sollas as leader, but it ended in failure owing to a breakdown of the diamond-drill borer, consequent upon an inrush of reef "sand." A second, which set out in 1897, having Prof. Edgeworth David, of Sydney, as conductor, and aided by the loyal co-operation of various authorities in Australia, so profited by past experience that a depth of 698 feet was attained; while a third, under the guidance of Mr. A. E. Finckh, also of Sydney, carried the main bore down to 1,114 feet.

The general story of the expeditions is given in the monograph by the leaders who took part in them, and the narratives, whether detailing the various steps in making borings, or treating of the difficulties and even dangers that were encountered, provide a fascinating chapter of plucky and long-sustained effort. Besides the primary purpose of the survey, a good deal of correlated scientific work was done, in which Capt. Field, R.N., of H.M.S. "Penguin," who conveyed the first party, took a prominent part. He made a complete topographical survey of the atoll, and charted an extensive series of soundings in the waters of the lagoon and the outer sea, as well as carrying out a magnetic survey of Funafuti, not alone in the interests of terrestrial magnetism, but as specially bearing upon the geological investigation that was in hand. Then again, the opportunity was embraced of making collections representative of the general fauna, flora, and anthropology of Funafuti and adjacent islands in the Ellici group.

The cores from the early borings, and that from the later and main bore, were all of them shipped to Prof. J. W. Judd, F.R.S., of the Royal College of Science, London, for detailed examination by him and by other experts, thus fulfilling Darwin's old wish, and it may be readily imagined that this transport virtually marked the commencement of the inquiry. Although many papers and memoirs in various departments of science have laid Funafuti under contribution during the years that have passed since the expeditions, it was only to be expected that a long interval would elapse before the materials that were obtained could form the subject of a satisfactory official report. The magnitude of the task is abundantly indicated by the present monograph.

Dr. G. J. Hinde supplies an elaborated descriptive account of the organisms which have contributed to the building up of the atoll, compiled from an examination of hundreds of microscopic core slittings and other desiderata. The evidence derived from this piece of work goes to show that, whether in the form of solid rock-cores or as incoherent granular particles, the material appears to be entirely of organic character, traceable to the calcareous skeletons of marine invertebrate animals and calcareous algæ; of the latter, Halimeda and Lithothamnion occur in abundance. And Prof. Judd's comment is that "from top to bottom the same organisms occur, sometimes plants, sometimes foraminifera, and sometimes corals predominating; but in the whole depth bored the same genera and species of these various groups of organisms take their part in the building up of the mass," a striking and significant summary. The only portion of a vertebrate noticed in the borings was a fragment of bone or spine, met with in the center of a core of compact dolomite, from a depth of 1,060 feet, which appears to belong to a fish. Mr. Finckh deals with the biology of the living reef-forming organisms at the atoll, and the mode of formation of rock brought about by their presence. He assigns their relative importance thus: (1) Lithothamnion, (2) Halimeda, (3) the Foraminifera, (4) the Corals. This, and another important section on the geology of Funafuti, by Prof. Edgeworth David and Mr. G. Sweet, are of especial value.

The conclusions reached in this opportune monograph are presented in no controversial fashion; the idea has been to put forward facts and leave the interpretation to others. But unfolding as they do the conditions surrounding the present-day life of an atoll and the structure of the deeper parts of its body, they will be read with profound interest by all who study the problems indicated by the formation of coral reefs.

THE UNITED STATES IN 1903.

The Statistical Abstract of the United States for the year 1903, issued by the Department of Commerce and Labor through its Bureau of Statistics, has just made its appearance. It is a solid mass of 650 pages of figures, with scarcely a line of "reading matter" other than the tables of figures and their necessary headlines. Yet a study of its tabular statements develops many interesting facts about the United States, its progress, development, and relation to the other countries of the world. It is interesting, for example, to observe, as shown on page 564, that the exports of domestic products from the United States now exceed those of any other country of the world. They amounted to $1,392,231,000, against $1,379,283,000 from the United Kingdom, $1,113,313,000 from Germany, $820,671,000 from France, and $732,975,000 from Netherlands. In imports the United States stands third, the world's largest importer being the United Kingdom, $2,571,416,000; Germany second, $1,340,178,000; the United States third, $1,025,719,000; Netherlands fourth, $867,308,000, and France fifth, $848,046,000. The above figures of imports and exports are, in the case of the United States, for the year ending June 30, 1903; the others, the calendar year 1902.

Regarding the details of the foreign commerce of the United States, the Abstract shows that 72 per cent of the exports were sent to Europe, 15 per cent to North America, and the remainder distributed in much smaller percentages to South America, Asia, Oceania, and Africa. The total value of the exports from the United States to Europe in 1903 was $1,029,256,000; to North America, $215,483,000; to South America, $41,138,000; to Asia, $58,359,000; to Oceania, $37,468,000; and to Africa, $38,437,000. Considering the exports by countries, the largest total is to the United Kingdom, $524,263,000; the next largest to Germany, $193,842,000; and to Canada, $123,267,000.

Comparing conditions in 1903 with those of 1873, the exports have grown from $522,000,000 to $1,420,000,000, including domestic products and foreign merchandise re-exported. Agricultural products of course still form the largest group of exports, amounting to $873,000,000 in 1903, or 63 per cent of the total, while manufactures amount to $407,000,000, or 29 per cent of the total. Manufactures are, however, gaining rapidly upon agricultural products in the share which they form of the total exports. In 1880 agricultural products formed 83 per cent and manufactures but 12½ per cent of the total exports of domestic products, while in 1903, as already indicated, agricultural products formed 63 per cent and manufactures over 29 per cent of the total.

The value of domestic manufactures exported had never reached so much as $100,000,000 prior to 1876, and in 1896 for the first time crossed the $200,000,000 line. Since 1896, however, the growth has been rapid, the total exceeding $300,000,000 in 1899, passing the $400,000,000 line in 1900, and remaining above $400,000,000 constantly since that date, with a prospect that the total exports of manufactures for the fiscal year 1904 will exceed in value those of any previous year.

SCIENCE NOTES.

Dr. Hildebrandsson has presented his report to the International Meteorological Committee respecting the position, number, and dimensions of the permanent air currents of the globe. The summary of this report as the result of direct observations is as follows: (1) Above the heat equator and the equatorial calms there is throughout the year a current from the east, which appears to have very great velocities at great altitudes. (2) Above the trade winds there is an anti-trade current from the southwest in the northern, and from the northwest in the southern, hemisphere, respectively. (3) This anti-trade wind does not extend farther than the polar limit of the ordinary trade winds, but is deflected more and more to the right in the northern, and more and more to the left in the southern hemisphere, until it finally becomes a current from the west above the crest of the tropical high-pressure belts, where it descends to supply the trades. (4) There is an anti-trade upper monsoon above the districts at the equatorial margin of the trades, the anti-trade in winter and the equatorial current from the east in summer. (5) From the tropical high-pressure belts, the air pressure decreases on the whole as it approaches the poles; while the air of the temperate zone is drawn into a vast polar whirl turning from west to east. The air of the higher strata flows away from the whirl, and the air of the lower strata flows toward the center of the whirl. Furthermore Dr. Hildebrandsson asserts that the theory that there is a vertical circulation of air from the equator to the higher regions, finally falling at the poles, is altogether a fallacy. Dr. Hildebrandsson's report is a valuable and important contribution to the science of the new meteorology, and destroys many existing notions respecting the permanent air currents of the world.

Before the Institution of Civil Engineers, on December 22, Dr. T. E. Stanton read a paper on the resistance of plane surfaces in a uniform current of air. The paper deals with the results of experiments made in the engineering department of the National Physical Laboratory on the distribution and intensity of the pressure on thin plates and combinations of plates placed in a uniform current of air, and is intended as the first part of a research on the nature and distribution of the pressure of the wind on structures. By a uniform current of air is meant a current in what is known as "eddying motion" as distinguished from stream-line motion, the mean velocity at any point in the direction of flow being uniform across the current. This condition of motion is considered to be the nearest approximation to that of winds of fairly high intensity. The main object of the present research was to determine, if possible, a general relation between the velocity of the current, the dimensions of the plates, and the resultant pressure, as it was felt that experiments in the open air could not be undertaken with any prospect of success until some general relation of the kind has been established. The results of the experiments show that, under the given experimental conditions, a definite relation of the kind existed, and may be stated thus—for similar and similarly situated plates or combinations of plates in a uniform current of air, the intensity of pressure is the same for the same velocity of current and general atmospheric conditions. On the assumption that the motion of the wind approximates to that of a uniform current as defined above, the above relation shows that the distribution and intensity of the pressure of the wind on structures may be studied experimentally by means of models of the structures set up in a current of air produced by means of a fan, as in the present case. In illustration of this, the results of experiments made on models of roofs and lattice girders of simple form are given in the paper. Tabulated results are also given for the cases of parallel plates at varying distances apart, plates inclined at varying angles to the direction of the current, and the rectangular plates of varying ratio of length to width.

The Belgian and French governments have come to an agreement relating to the establishment of telegraph communication between the Congo Free States and the French Congo. Under the agreement a submarine cable is to be laid between Brazzaville and Kinshassa, the cost of which is to be borne equally by the two countries concerned. It is proposed to use Morse registering apparatus in the stations at either end of the cable. The tariff will probably be 2½d. a word, with a minimum rate of 10d. per message.

CONCRETE PILING.

The extensive improvements made at the Washington barracks have attracted not a little attention to a system of concrete piling which was there employed with marked success, and which promises to displace, for certain kinds of work, the wooden piles which have been used so long. The work at the Washington barracks presented obstacles which could not be overcome by the use of the ordinary pile—obstacles due to the constantly changing condition of the ground, which was alternately wet and dry as a result of heavy and frequent rains.

Through the courtesy of Mr. Frank S. Shuman, we are enabled to present the following description and the accompanying illustrations of this method of utilizing concrete piles.

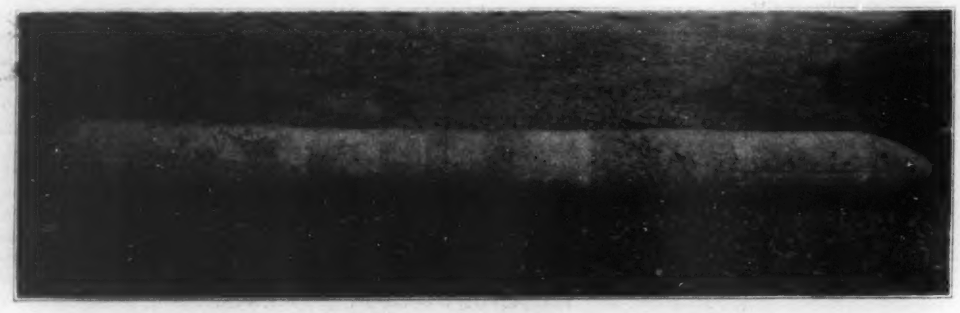
Four different types of piles are employed. The one illustrated in Fig. 1 A, and known as "the preparatory removable pile," is to be used in earth reasonably firm in its texture and free from water. A preparatory tube, consisting of a length of extra heavy iron pipe, fitted with a driving head of oak, and a conical steel point of a somewhat larger diameter than the pipe, is driven into the ground to the required depth, and thereupon withdrawn. The hole formed is filled with well-rammed concrete. Obviously, any desired length of pile can be obtained by driving the outer tube deep enough into the ground; and obviously that outer tube can be removed with but a fraction of the force required in pulling out or planting the ordinary pile. After the rammed concrete has once set, the pile becomes literally a pillar of stone. Fig. 1 B shows the general appearance of the pile after the removal of the outer tube. The frictional hold of the pile is much augmented, because the larger pieces of the aggregate are forced into the sides of the hole, thereby forming innumerable lateral anchors. We are informed that a pile of this type, 14 inches in diameter and 13 feet 2 inches in length, successfully sustained a direct pressure of more than 21 tons of pig iron for a period of ten days without any signs of settling.

It sometimes happens that the fixed steel point cannot be used to advantage. Particularly is this the case where the earth is soft or marshy, or where quicksand or water is encountered. For this purpose, a detachable point of concrete, as shown in Fig. 2 A, is substituted for the fixed steel point, and driven to the required depth. As the pipe is lifted out, concrete is rammed home through the pipe. A head of concrete is maintained inside the pipe while it is being gradually withdrawn. In this manner, all water is displaced, and the closing in of the sides of the aperture is avoided.

In driving piles under water, the system illustrated in Fig. 3 A is employed. The pipe with its concrete point is surrounded by a sheet-iron coffer-dam, which latter is temporarily clamped to the pipe, and is of sufficient length to reach from above the waterline down to the firm underlying ground. The pipe is driven in until the coffer-dam is embedded in the firm ground at a sufficient depth to prevent the possibility of water percolating through. The clamp is then removed, the concrete point is driven further down to the required depth, and concrete is filled in to the desired height. If the completed pile is to form the base of a sea wall, the concrete is filled in only flush with the river bottom (Fig. 3 B), and the sheet-iron coffer-dam is then removed and used for the next pile. If, on the other hand, the pile is required to rise above the water, as for example in the construction of a wharf, the sheet-iron coffer-dam is not removed, but is left in position and filled up with concrete (Fig. 3 C). To lend additional stability to a pile of this construction, a cylinder of 3-inch mesh expanded metal may be embedded in the concrete, and likewise a piece of structural iron, to which the superstructure can be fastened.

In soil that is alternately wet and dry, these piles are obviously able to provide a permanent foundation, which could not be secured by wooden piles. The system is economical and easy of application.

Concrete Points for Long, 17-inch Diameter Piles. Engineers' School, Washington Barracks, D. C.



Concrete Pile, 13 Feet 2 Inches Long by 14 Inches Diameter. Dug Out Perfectly Intact After Test.

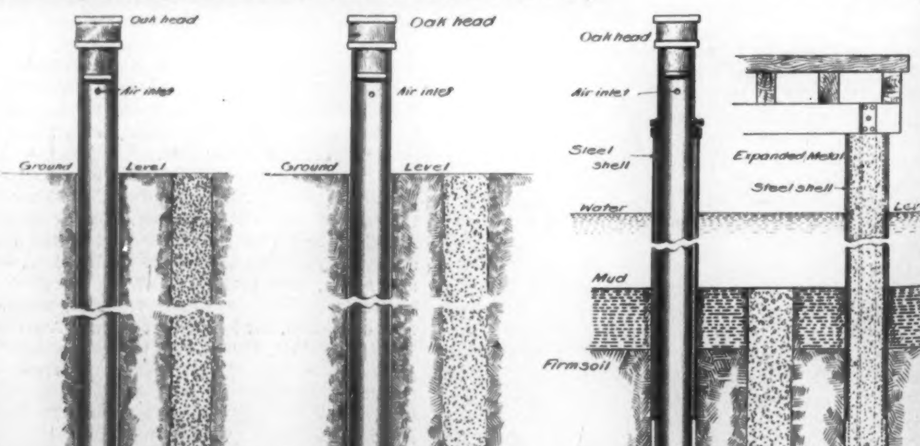
The First Modern Ship Canal.

In these days of ship canals we hear little or nothing about the earliest enterprise of the kind during modern times, namely, the Berkeley and Gloucester Ship Canal. Although Gloucester is situated on the Severn, access to the port is really afforded by the canal. Owing to the dangerous condition of the river, an Act was obtained in 1793 for the construction of a ship canal commencing at Berkeley, some sixteen miles lower down the Severn, and the works were completed in the year 1827. This waterway follows the Vale of Berkeley, originally commencing with a tidal-basin and lock at Sharpness Point and ending at the docks in Gloucester, where there is another lock communicating with the Severn. The original cost was about £500,000, but within the last forty years considerable outlay has been incurred in opening a new entrance half a mile lower down the river, with additional dock accommodation. These works were finally completed in 1874.

Although vessels of more than 600 tons cannot pass up the canal to the port, ships of 2,500 tons can enter the outer basin, where cargo is transferred to barges. The dimensions of this ship canal may be small compared with more recent developments, but its continuously successful operation has certainly had some useful effect in the encouragement of more ambitious schemes of the same kind.—Builder.

The topography of the Pennsylvania anthracite coal regions is shown at the World's Fair by a large relief map. A model of a mining plant, showing both the interior and exterior works, forms a part of the exhibit. The actual position of coal seams under the surface is shown by means of cross sections. An actual breaker is shown in operation.

Preparatory Pile Removed, Leaving Hole Ready for Concrete.

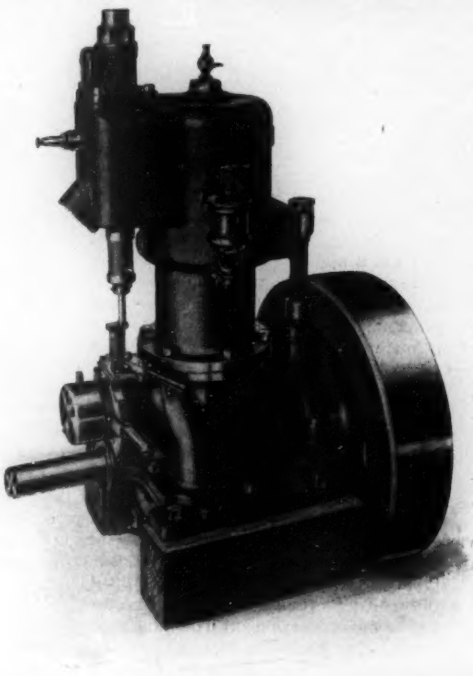


Various Systems of Concrete Piling.

CONCRETE PILING.

A SINGLE-CYLINDER, REVERSIBLE, FOUR-CYCLE GASOLINE ENGINE.

The engine shown in the accompanying cut is the invention of Mr. A. F. Law, of Bridgeport, Conn., and is manufactured by the Royal Equipment Company, of that city. It is of the usual four-cycle type, having a 4-inch bore by 5-inch stroke, and is adapted especially for marine purposes, where its use makes a reversible-blade propeller or other reversing gear unnecessary, except in cases where the boat must always be instantly reversible. The marine motor is rated at 3 horse-power at 600 R. P. M., and it can be made to develop 5 horse-power by running it at a higher speed. Its weight complete is 235 pounds. The plunger water pump seen beside the cylinder, in front, is driven by an eccentric beside the flywheel. Variable jump-spark ignition is used, the spark being advanced or retarded by moving vertically over its notched segment the lower of the two levers seen beside the base. The upper lever, which moves in a horizontal direction, shifts the small plunger that operates the exhaust valve, from the regular cam on the secondary, or half-speed, shaft to another cam beside it, which is set so as to open and close the valve at the proper time when the engine is running backward. To reverse, it is only necessary to cut off the ignition current when the motor is running with the spark advanced, throw over the reversing lever as soon as the motor slows down, and cut in the ignition current again. The spark, being advanced for running forward, will of course be retarded for running backward, and as soon as the motor starts to turn in the latter direction, the spark must be advanced in order to secure full power.



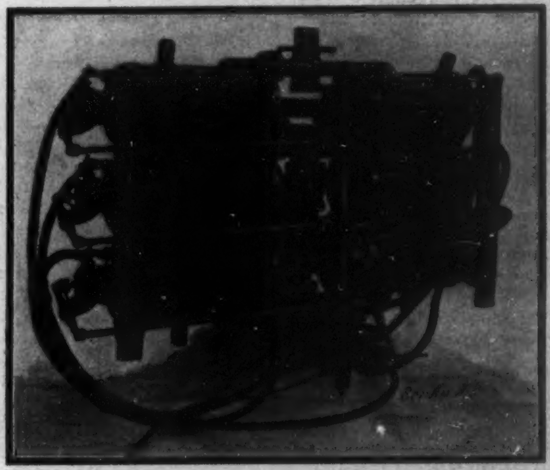
A NOVEL, FOUR-CYCLE, REVERSIBLE, GASOLINE MOTOR.

The motor can generally be reversed without stopping it, but, in the event that it does stop while being reversed, it can of course be at once started again by hand in the reverse direction. In other words, this four-cycle engine comprises all the advantages of engines of this type, with the reversible feature of the two-cycle engine added. The engine is well constructed throughout, has a hand-hole in the base for adjusting bearings, and is built up to a four-cylinder size, which, for automobile use, is rated at 20 horse-power.

As stated in a paper recently read before the Russian Physico-Chemical Society, Mr. N. Awerkieff observed that in connection with the action of hydrochloric acid on metallic gold in the presence of formaldehyde, trioxmethyl, methyl, ethyl, and amyl alcohol, as well as in that of phenol, chloroform, and several other organic bodies, a dissolution of the gold would take place. The solutions obtained in this way, on being vaporized, dried, and heated, would leave a residuum of metallic gold.

A NEW GASOLINE MOTOR FOR AIRSHIPS.

The six-cylinder motor shown herewith was designed and built by Mr. Charles E. Duryea, of the Duryea Power Company, Reading, Pa., for use on an airship. The cylinders have a 4½-inch bore and the pistons a 5½-inch stroke, and when turning at 900 R. P. M. the motor developed 40½ horse-power. Its weight stripped, as shown, but with complete equipment of two carbureters, battery, spark coil, water, and gasoline tanks, with a gallon of the respective liquids in each, was 232 pounds, or less than 5¾ pounds per horse-power. The three-throw crank shaft of 1⅝-inch diameter is hand forged and has a ⅝-inch hole bored in it to carry oil to the crank pins. These are 1⅛-inch in diameter and are provided with a ¼-inch central hole for oiling. The wrist pins of the pistons are hollow and are plugged so as to prevent the oil going out at the bottom. Instead of setscrews to hold them in place, oil cups screw into the lug on the inside of the piston wall. These oil cups have an opening on the upper side for filling, and they can be filled when the piston is at the end of its stroke. The reciprocating motion causes the oil to feed properly. The cylinders of the motor are of cast iron, machined inside and outside. They are fitted with copper water jackets. At the base of each cylinder there is a slightly conical space on which the copper water jacket fits with a steel ring around it, which, when it is driven up on the cone, clamps the jacket to it, making a tight joint. The motor is a particularly light and compact one, and should fulfill well the purpose for which it was designed.



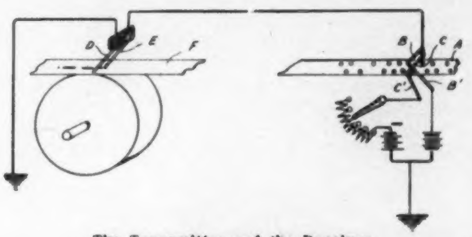
A 40½-H. P., WATER-COOLED, GASOLINE MOTOR FOR AN AIRSHIP.

A NEW SYSTEM OF RAPID TELEGRAPHY.

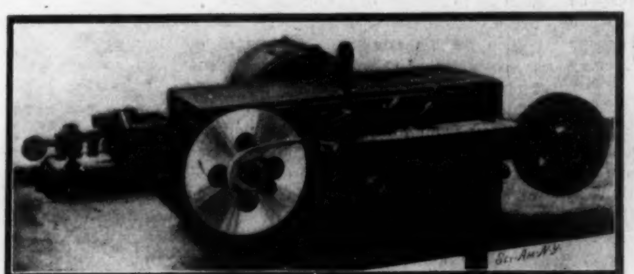
The difficulties which have hitherto blocked the path to the invention of a successful high-speed telegraph system are of an electrical, rather than a mechanical nature. Many transmitters and receivers have been devised, which are mechanically capable of operating at a high rate of speed; but which have utterly failed when used on any but short telegraph lines, because, owing to static capacity of the line, they are too rapid for the electric impulses. A telegraph line presents features and effects similar to those of a Leyden jar. Though these effects are too small to be noticeable in a short line, in a distance of several hundred miles they become so great as to seriously interfere with high-speed transmission of telegraphic signals. Dots and dashes, instead of being sharply defined, are prolonged until they are run together by the sluggishly flowing current, rendering the message unintelligible.

A system recently invented by Mr. Patrick B. Delany, of South Orange, N. J., is not in the least hindered by the static capacity of the line; but on the contrary utilizes the "static discharge" and is inoperative without it, so that, when used on short lines whose capacity is small, it is necessary to bring these lines up to the requisite capacity by the use of condensers. The system is designed to transmit and receive messages at the rate of one thousand words a minute over distances of one thousand miles, though a speed of eight thousand words a minute has been attained on a short experimental line. In the accompanying illustrations we show the three machines which are used in the operation of this system, namely, the perforator, the transmitter, and the recorder. Messages are sent by means of a perforated tape, which is prepared in the perforating machine. The tape is drawn at any desired speed through the perforating machine under a pair of steel punches. Each of these punches is operated by a magnet. The magnets are controlled by a Morse transmitting key, shown at the right in our illustration. A downward stroke of the key causes one of the punches to operate, and on release of the key the other punch operates. Thus each operation of a key, whether for a dot or a dash, serves to make two perforations, one near the upper edge, and the other near the lower edge of the tape. As shown in our illustration of the perforated tape, the primary and secondary perforations have an angular relation to each other, which is due to the fact that the tape is constantly running, and which varies with the interval of time between the downward stroke and release of the key. When a message has been perforated in the tape, the latter is passed through the transmitting machine. Here the primary perforations co-operate with suitable mechanism to send positive electric impulses through the line, while the secondary perforations permit the passage of negative electric impulses.

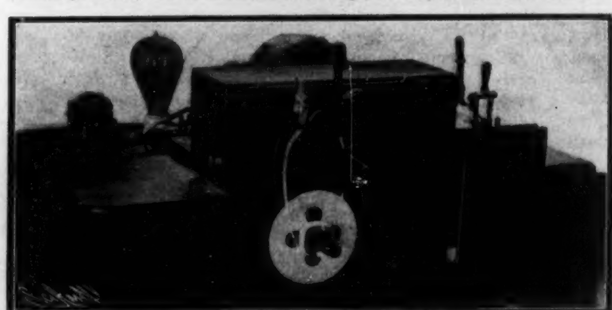
The accompanying diagram clearly shows the method of sending and receiving the message. The perforated tape, A, at the transmitting end passes between two primary contact fingers, B and B', and two secondary contact fingers, C and C'; B' is connected with the positive pole of a battery whose



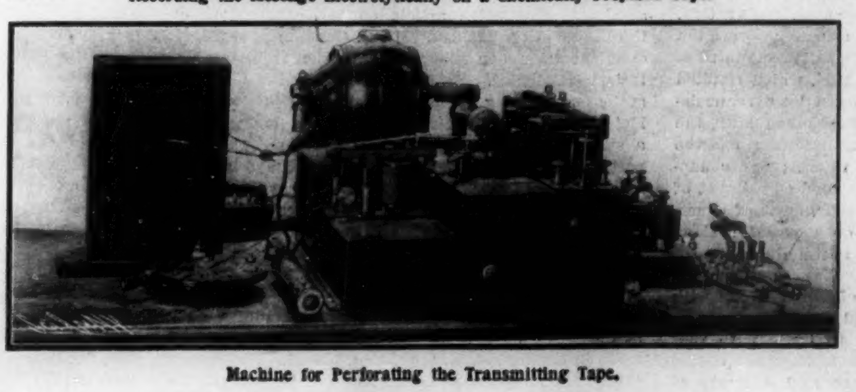
The Transmitter and the Receiver.



Message Ready for Transmission at a Speed of 1,000 Words a Minute



Recording the Message Electrolytically on a Chemically-Prepared Tape.



Machine for Perforating the Transmitting Tape.

A NEW SYSTEM OF RAPID TELEGRAPHY.

negative pole is earthed, and C' is connected with the negative pole of a battery whose positive pole is earthed. When the fingers, B and B', make a contact through a perforation in the tape, they send a positive impulse over the line. This impulse is followed at the proper interval by a negative impulse by contact of fingers C and C' through the secondary perforation. The signal is electrolytically recorded at the receiving end on a chemically-prepared tape, F, by means of an iron electrode, E, connected to the line and a platinum electrode, D, connected to earth. The current in passing through the moistened chemical tape from the iron to the platinum electrode forms a blue mark on the tape, at the contact point of the iron finger. When the current is reversed, no such mark is formed. A momentary positive impulse sent by contact fingers B and B' causes such a mark to be

The Same Word as Perforated on the Transmitting Tape and Electrolytically Produced on the Recording Tape.

produced on the moving tape at E, and this mark is protracted by the slow outflowing current, which is retarded by the inductive capacity of the line, until a negative impulse produced on contact of fingers C and C' abruptly stops this after-flow by reversing the current. Thus it will be seen that the impulses, whether for a dot or a dash, are all of equal duration, and it is the interval between the positive and negative impulses that determines the length of the mark on the paper.

The practical advantages of this system will be readily comprehended. A number of perforating machines can be used in connection with a single transmitter, so that a large number of messages can be prepared simultaneously, and then passed through the transmitter at speeds of 1,000 or more words a minute. Furthermore, Mr. Delany has invented a perforating machine, which is operated from a keyboard similar to that of a typewriter. This can be operated by any typewritist at twice the speed at which the Morse keys are ordinarily operated, and if desired can be used in any business office to perforate messages on the tape. The tape can then be sent to the telegraph station, and run at a high speed through the transmitting machine. At the receiving end the record may be transcribed before being sent out, or the original may be sent to its destination, where any typewritist who has had a few days' instruction can reproduce the message in typewritten form, and in this way absolute secrecy in transmitting the message can be maintained.

Commercial Korea.

"Commercial Korea in 1904" is the title of a monograph just issued by the Department of Commerce and Labor through its Bureau of Statistics. It discusses commercial and other conditions in Korea, showing area, population, transportation facilities, railways, telegraphs, postal service, and foreign commerce, including imports and the countries from which they are drawn, and exports and the countries to which they are sent. The population of Korea the monograph in question puts at about 15 millions in round numbers, the area at about equal to that of the State of Kansas, and the foreign commerce at about $12,000,000, of which imports form about $7,500,000. A part of the Chinese Empire prior to the Christian era, Korea remained under the control of that country until about the end of the sixteenth century, when the Japanese sent a large invading army to Korea for the purpose of driving out the Chinese and taking possession. The Japanese rule, however, was comparatively brief, and in 1627 the people of Manchuria placed the country under vassalage, and until 1894 Korea recognized the control of China by sending tribute-bearing missions annually to Peking.

In 1894 an insurrection led the country to ask aid from China, and Chinese troops were sent. This action, being looked upon by the Japanese as a step toward the complete control of Korea by China, precipitated a war between China and Japan in 1894, which resulted favorably to Japan and was followed by a renunciation of Chinese sovereignty by the Korean king, the substitution of Japanese for Chinese influence, and the introduction of many important reforms under Japanese advisers. These reforms included adjustment of taxation, abolition of slavery, establishment of educational institutions, introduction of a postal system, membership in the International Postal Union, and a reform of the judiciary.

Commercially the development of Korea begins with 1876, when two ports, Gensan and Fusan, were, upon the insistence of Japan, opened to trade with that country only. In 1882 Admiral Shufeldt, of the United States navy, visited Korea and secured a treaty of friendship between the United States and Korea by which American vessels were given access to its treaty ports and the safety of American vessels and citizens assured. This was followed by treaties with Germany and Great Britain in 1883, Russia and Italy in 1884, France in 1886, Austria in 1892, and China in 1897. The formation of the treaty between Korea and the United States in 1882 was immediately followed by a visit from a Korean embassy to Washington, sent to exchange ratifications of the treaty. From this time forward Korea was opened to foreign trade and Western civilization, and the Korean government established its legations in the United States and other great commercial nations. With the opening of the treaty ports and the establishment of commerce an official record of Korean imports and exports began. This shows imports in 1884 amounting to about $800,000 and exports amounting to $475,000. By 1890 imports had grown to $3,850,000 and exports to $2,975,000. In 1894 imports and exports fell considerably below those of 1890, but in 1897 again increased, being for that year of imports about $5,000,000 and exports about $500,000. In 1902 the imports at the treaty ports amounted to about $7,000,000 and the exports of merchandise to about $4,200,000. In addition to this, exports of gold amounted to over $2,000,000, while the imports and exports at other than treaty ports are estimated as being sufficient to bring the total commerce of 1902 up to fully $15,000,000, exclusive of gold exports, which, as above indicated, amounted to about $2,000,000.

The most important articles in the export trade are rice, which shows an annual exportation of more than $1,000,000; beans, $500,000; ginseng, nearly $500,000; and hides, about $100,000 in value in the latest available year. Of the importations, cotton goods form the largest item, from $3,000,000 to $3,500,000 per annum; silk piece goods imported from Japan and China amount to $600,000 per annum; kerosene oil, about $300,000; railway materials, about $250,000; mining supplies, about $200,000; and bags and ropes for packing, $150,000. Of the cotton goods imported in 1902, British shirtings formed the largest single item, amounting to $800,000; British and American sheetings, $260,000; Japanese sheetings, $350,000; Japanese piece goods and yarn for use in manufacturing cotton cloths, $800,000. Korea, like China, is now drawing considerable quantities of cotton yarn from Japan, and considerable supplies of cotton manufactures. Great progress is being made by Japan in the manufacture of cotton, and in addition to supplying cotton cloths to China and Korea in large quantities it is now supplying the cotton yarns which are used in household manufacture as well as in certain of the cotton mills which exist, and are proving quite successful.

The foreign commerce is carried on through the treaty ports of Chemulpo, Fusan, Wonsan, Chinampo, Mokpo, Kunsan, Masampo, and Song Chin. Chemulpo, which is located on the western coast of Korea, about midway from its southernmost point to the northern boundary, has by far the largest commerce. Its imports in 1902 were reported at $1,250,000 out of a total of $1,920,000. The exports of Chemulpo, however, are very much less than those of other ports, being $45,000 in 1902 out of a total of $1,830,000. Its pre-eminence over the other treaty ports as a point of importation is due largely to the fact that it is of itself a considerable city with a comparatively large foreign population and is in direct railway communication with the capital of Korea, Seoul, which is only 35 miles distant.

The principal imports in 1902, stated in United States currency, are as follows: Shirtings, gray and white, $860,000; silk piece goods, $480,000; cotton yarn, $490,000; American kerosene, $385,000; Japanese sheetings, $380,000; Japanese piece goods, cotton, $325,000; British and American sheetings, $285,000; grass cloth, $285,000; railway plant and material, $230,000; bags and ropes for packing, $150,000; mining supplies, $230,000; clothing and haberdashery, $100,000; provisions, $95,000; matches, $90,000; saké samshu, $75,000; sugar, $74,000; machinery, $70,000; cotton wadding, $60,000.

The Current Supplement.

The current Supplement, No. 1473, opens with an admirably illustrated article on the canalization of the Elbe and the Moldau. Mr. O. Chanute presents an excellent discussion of aerial navigation from the historical standpoint. Emile Guarini describes the Dick system of lighting trains by electricity. "Coloring of Metals" is the title of a paper by Paul Malherbe on a subject which is of considerable technological importance. A simple explanation of the N-rays is given for the benefit of those readers who have not been able to follow the more technical articles which have thus far appeared. Mr. Foster H. Jenings begins a very thorough treatise on Korean headdress, which is well illustrated by pen-and-ink drawings.

Workmen are installing the wonderful floral clock at the World's Fair. The steel framework, which was made in Milwaukee, Wis., is being placed. The flowers that will conceal the mechanism are in pots in the greenhouses, and will be installed about April 15. The dial of the clock is 112 feet across.

THE NEW VICKERS-MAXIM 9.2-INCH WIRE-WOUND GUN.

The powerful weapon which we illustrate on the front page of this issue is a good representative of the latest improvements which have been introduced into heavy ordnance, with a view to securing at once greater range, increased penetration, and a higher rapidity of fire, without adding materially to the weight of the piece. The theory of design and methods of construction by which these results have been secured are not by any means peculiar to this piece, inasmuch as they have been followed by gun makers for many years; but the significance of this 9.2-inch gun is that in it we see what is, perhaps, the most successful combination of these qualities that has yet been attained. Although this gun weighs only 28 tons, and has a service rapidity of fire of five rounds in a minute and a half, it has a power of penetration at 3,000 yards (the minimum fighting range of to-day) approximately equal to that of the 13½-inch English gun, of more than twice the weight, of a dozen years ago.

The immediate cause of this increase in efficiency is the greater velocities that are secured with modern guns; and the increase in velocity is due to the enlargement of the powder chamber, the use of slow-burning powder, and the lengthening of the bore, so as to enable the products of combustion as they are given off by the burning powder to exert their accelerating effect upon the projectile for a longer period and with a higher average pressure. To such a successful point have these principles been carried, that the latest types of gun, such as the one herewith shown, have fully fifty per cent greater velocity than the guns of ten or fifteen years ago. The gun weighs 28 tons, has a total length of 37.2 feet, a bore of 9.2 inches, and measures 36 inches in external diameter at the breech and 18 inches at the muzzle. It fires a 380-pound projectile with a muzzle velocity of 2,900 feet per second, and a muzzle energy of 22,160 foot-tons. The penetration of wrought iron at the muzzle is 37 inches, and at the minimum fighting range of 3,000 yards its projectile striking squarely would pass through 11 inches of Krupp steel, so that the water-line armor of practically every battleship afloat would be penetrable by this gun.

The piece is built by the wire-wound method. It consists of an inner tube containing the powder chamber and the rifling, over which is shrunk a heavier inclosing tube of gun steel, and upon this is wound, under very high tension, the wire upon which the gun mainly depends for its tangential strength. Over the wire is shrunk on a single heavy jacket, which extends from the breech for nearly two-thirds of the length of the gun, and a chase hoop, or tube, which extends to the muzzle, which latter is slightly swelled to a large diameter, to give the extra reinforcement needed to prevent splitting at this point.

The breech mechanism is shown very clearly in our illustrations. The whole of the breech action, namely, unscrewing the plug, withdrawing it, and swinging it clear of the breech box, is accomplished by the continuous rotation of the hand-wheel shown to the right of the breech. The breech plug is of the same type as that used in our navy. It is threaded in segmental portions on steps of varying radii, an arrangement which enables three-quarters of its circumference to be threaded, and to be available for meeting the longitudinal thrust on the block. The ordinary type of block has only half of its circumference threaded, so that the new type of plug may be made proportionately shorter than the old. This shortness of the plug enables it to be swung clear from the breech as soon as it is unscrewed, thus saving the time occupied in the old type of block in withdrawing the plug in line with the axis of the gun, before swinging it clear of the breech box.

Another element of interest in this gun is found in the fact that it is built upon the same principles and is of the same general efficiency as the Armstrong gun, with which nearly the whole of the Japanese navy is armed; although it should be understood that this particular caliber of gun is not used by the Japanese, whose battleships and cruisers are armed with the 12-inch, 8-inch, 6-inch, and 4.7-inch Armstrong guns. The 9.2-inch gun, however, forms the primary armament of the British cruisers, and the intermediate battery of the latest types of British battleships, just as the 8-inch gun occupies the same place in the respective classes of ships of our own navy. The latest British designs carry eight of these 9.2-inch guns in four barbettes, in addition to the primary armament of four 12-inch guns—an impressive evidence of the vast increase in the offensive power of warships, due to the improvement of ordnance and the increase in displacement.

Underground hospitals and mule stables, methods of ventilating and draining mines, of robbing pillars, and flooding with culm are illustrated in an interesting world's Fair exhibit made by the Pennsylvania commission in the Palace of Mines and Metallurgy at the World's Fair.

Correspondence.

A Letter from Leo Stevens.

To the Editor of the SCIENTIFIC AMERICAN:

I have decided not to enter the airship contest at St. Louis. The speed expected is too great. The man who enters this contest has everything to lose and nothing to gain.

The rules call for a speed of at least 20 miles per hour. This is impossible. The prize is perfectly safe with the Exposition Company.

I think the rules might have been modified just a little. For instance, the man making best time should be allowed to take first prize, second man second prize, and third man third prize. There would then be something in sight. Many Americans would certainly enter.

I will continue experimenting in this vicinity during this year and will prove what the American can do.

Aeronaut LEO STEVENS.

New York, March 5, 1904.

[The rules governing the airship competition at St. Louis have, we understand, recently been modified, so that the speed required is now 18¾ miles an hour, and the course to be covered 10 miles.—ED.]

Draper's Specula Test.

To the Editor of the SCIENTIFIC AMERICAN:

A paper by myself upon the above subject was published in the SUPPLEMENT, page 23232. A criticism by Mr. Edmund M. Tydeman appears in the SCIENTIFIC AMERICAN for November 14, page 348. Residence in Australia precluded earlier rejoinder.

In my paper, by a purely analytical method, developed step by step from first principles, and given *in extenso* to enable the results to be checked, the connection between variation of ordinate and variation of the position of the axial intersection of a ray after reflection from a parabolic surface is demonstrated. The results are compared with those computed for identical conditions by Draper's rule, and the latter is proved to be 50 per cent in error.

Mr. Tydeman in his strictures has wholly failed to grasp the significance of the third (III.) premise, clearly expressed, of the analysis, or to assimilate the subsequent treatment. Mr. Tydeman misquotes. In the second paragraph the factors represented by x and z are transposed; by this and the succeeding quotation a serious false issue has been raised. In the next instance the expression the "*constant H P*" (italicized in the letter) is substituted for the correct definition—"normal"—used by me. The position of the critic that the angle contained by an incident and reflected ray is *not* bisected by the correlated normal (not "*constant*" as wrongly quoted) $D\ H$ to the reflecting surface is, of course, untenable. The matter, although a most essential point, is, optically, elementary; bisection is the corollary of Newton's second axiom in optics, hitherto unquestioned.

In the same paragraph Foucault's and Draper's methods are classed together as though identical; they differ broadly, as all who have used both know, and as recourse to the original memoirs will prove. In compilations they are not infrequently erroneously conjoined. My paper deals specifically with Draper's formula.

In the last paragraph Draper's formula is defended by attributing error to rules differing from it.

The errors and misapprehensions indicated wholly vitiate the criticism, and confirm the opinion that the reputation of the reflecting telescope, as an instrument of precision, has suffered by the unquestioning acceptance, without investigation as to their genesis, of "authoritative" formulæ.

It is assumed that the original will be compared by those interested.

JAS. ALEX SMITH.

Melbourne, January 13, 1904.

Actinic Light.

To the Editor of the SCIENTIFIC AMERICAN:

An article on "Some Experiments with Actinic Light," by J. W. Kime, M.D., appeared in the SCIENTIFIC AMERICAN for June 20, 1903. There are in this article several very misleading statements and erroneous conclusions. Soon after its appearance, having occasion to prepare a paper for the Scientific Society of the Ohio University, with the help of Mr. J. O. Wright, assistant in the department of physics and electrical engineering, I prepared to demonstrate the fallacies of Mr. Kime, and to set forth the correct views of the subject. This was done by citing authorities, by a number of experiments, and by the use of lantern slides showing the effects of light under a number of different conditions.

In this communication I only desire to select from the paper above referred to a few points, which will sufficiently show forth Mr. Kime's mistaken notions about actinic light.

In the very first paragraph we read, "the light of the sun is composed of *three distinct kinds of rays*, luminous, heat, and chemical, or actinic." Italics are mine. Now, the fact is, the only inherent physical difference in light waves so called, is one of *wave length*. Moreover, the very same rays may produce all three of the effects named, though in varying degrees depending on the wave length. Electro-magnetic waves of the magnitude of sound-producing air waves are now utilized in the transmission of wireless messages; when they are much shorter, and approach the infrared, but still too long to affect the sense of sight, they begin to produce heat. Still shorter, produce more intense heat effect. When we come into the region of $\lambda = 0.8\ \mu$ (micron), we have the first visible portion of the spectrum. As the waves become shorter and shorter, the color changes through orange, yellow, green, blue, indigo, to violet, $\lambda = 0.36\ \mu$, the heat effect in the meantime decreasing and the actinic effect increasing. Passing out into the ultra-violet invisible rays, the chemical action continues to increase; indeed, it is those radiations whose wave lengths are below 0.36 micron which produce the greatest part of the total chemical effect of a given beam of light. Continuing down the scale, we reach the extremely short waves, which exhibit the properties attributed to the X-rays.

It is at least misleading to speak of "those bands of the spectrum which are rich" and "those which are poor" in certain rays. It leaves the impression all the time that a mixture of rays of very different properties, regardless of wave length, is to be understood. Color itself is subjective, the physiological and psychological effect of wave length. Therefore it is absurd to speak of a color being rich or poor in heat or actinism.

In Mr. Kime's fifth paragraph he explains that colored strips of glass corresponding to the spectrum colors were used. "In this manner," he says, "we obtained a *true photograph of actinic light*," etc. In his sixth paragraph we read, "we are unable to recognize any difference whatever between the open space (no colored glass) and the blue glass." Also, he says less light passed through clear glass (one thickness) than either the clear space or the blue glass. These statements will be examined further down. In the next paragraph he concludes from his observations just quoted that "blue glass cuts off no chemical light," and that "the ultra-violet rays are either not markedly actinic, or that blue glass does not retard their passage. It is very evident one hundred per cent of actinic light has reached the plate through the blue glass." He also finds no regularity of actinic effect. "The yellow," he informs us, "transmits an *appreciable* amount, and the green *just enough* to be seen. From this point we jump from almost zero in the green to *one hundred per cent* in the blue." "In the violet," again, "we drop back to almost the same percentage as in the yellow." And now to the profound and revolutionary conclusion that "*wave length has nothing to do with determining the chemical activity of light.*" From this list of insufficient and erroneous data he further generalizes: "It is apparent from our photographs that color, *independently of wave length, influences the chemical action of light.*" In all cases the italics are mine.

In the paragraph headed "Experiment No. 2," Mr. Kime either does not say what he intends, or else he does not know exactly what his photographer did. He informs his readers that No. 2 is a positive, yet immediately says it was taken on sensitized paper, just as No. 1 was taken on a dry plate. If this last is true, then No. 2 is a negative, just as No. 1. But anyone with the most rudimentary knowledge of photography knows that No. 2 *is* a positive, as stated at first. If so, then it was never printed through the glass strips as was No. 1. Moreover, a glance at once shows that No. 2 was obtained as a positive print through the negative corresponding to No. 1. The No. 1 may also have been made on paper as well as on glass. I do not see how we can do better than count as worthless all conclusions and inferences about relative actinic values when based upon experiments made, apparently, in darkness of the most elementary laws of light. We are also unable to make any extenuation, however conclusive the author of these experiments would have his results appear, in that they were "confirmed by repeatedly going over the experiments, and always with like findings."

Now to illustrate by a few notes from our own experiments the results obtained therefrom. In timing the exposures a seconds pendulum was used, being arranged so as to indicate magnetically its successive passages. In the development exactly the same kind of plates and developer were used throughout, and subjected to the same length of development where results in any way depended upon these conditions.

Two sets of negatives were made with 1.5 seconds exposure and 2 minutes development, under colored films, arranged to give six of the seven spectrum colors. The one set resulted from exposure to sunlight, diffused, and no glass intervening; the other set was exposed through four thicknesses of glass. In the positives the colors, beginning at the left in each, were red, orange, yellow, green, blue, and violet, the indigo being omitted. There was observed a slight actinic effect through the red; orange, yellow, and green, practically none; blue and violet are alike strongly actinic. This photograph differed from Mr. Kime's result, as well it might. The effects in both sets are equally strong, both in the negative and in the print. The intervening glass, even four thicknesses, caused no difference capable of detection by this means when the visible portion of the spectrum, or that which apparently represents it, is employed. It is well known, however, that glass does have a powerful absorptive effect on those waves lying in the ultra-violet section, so that prisms and lenses made of quartz should be used when studying this portion. For convenience the above colors are 5, 7, 30, 30, 23, 28.

Another positive was made from a negative taken through six films arranged to represent the spectrum, and exposed six seconds, developed five minutes. The colors were 6, 17, 8, 10, 11, 27. Here the red, orange, yellow, and green cut off all actinic rays. The blue and violet only slightly absorb them.

Still another positive was made through seven films, 16, 7, 21, 30, 22, 12, 29. In this the red showed slight effect, orange none, yellow strong, green none, blue and indigo same as the yellow, none of them being 100 per cent. The violet absorbs a large part of the actinic waves. This supposed spectrum would be considered quite anomalous, did we not bear in mind that we are using colored films instead of the true spectrum.

Other photographs were made which showed the actinic effects of the wave lengths in the true spectrum of the voltaic arc. The spectrum was produced by projecting the light from the crater of the electric arc through a glass prism. The visible portion of the spectrum was about three feet long and one foot deep, so that ample room was given for studying the effects in the various bands, and indeed for several positions in the same color. Reference marks were made on the screen, so that the same positions could be used with accuracy any number of times. Mr. Wright constructed an apparatus for exposing successive parts of the same plate in successive parts of the spectrum. His arrangement permitted as many as ten exposures on the same plate.

We made a photograph to show the results in infrared, red, orange, yellow, green, blue, indigo, two positions in the violet, ultra-violet. The negative and print showed nothing for infra-red and red, orange very faint, yellow slightly stronger, still more intense in the green; neither plate nor print shows any difference for the blue, indigo, violet, and ultra-violet. It is known, however, that the effect *does actually* increase into the ultra-violet before beginning to decrease again.

A photograph from red, orange, yellow, green, blue, indigo, two in violet, ultra-violet, and ultra-violet taken far out, perhaps 12 inches beyond the last of the visible violet, showed a perceptible diminution of actinic intensity in the last band.

The conclusions from these data are obvious. It is certainly altogether unreliable to use colored glass or colored films to represent the spectrum. Their coloring matter may absorb some of the waves corresponding to their own apparent color, or let pass waves not corresponding to their color, or both. The experiments cited show that different films of apparently like color produced quite diverse photographic results. Further, it is certainly clear that there *is no irregularity* in the actinic effect, but rather that it increases progressively even to $\lambda = 0.36\ \mu$, or less, from which point it begins to decrease. *Wave length, and not color,* determines the actinic effect, as it does every other property of electro-magnetic radiation.

A. A. ATKINSON.

Physical Laboratory, Ohio University, Athens, Ohio.

A Union Building for New York Engineers.

With the present of $1,500,000 made recently to the Mechanical, Mining and Electrical Engineers of this city, and the Engineers' Club, steps were immediately taken toward the completion of plans for a union building, which the gift provides for. The building will have a 125-foot frontage on West Thirty-ninth Street, and will be backed by the new Engineers' Club building—a separate structure opposite the new Public Library on West Fortieth Street. It will probably be twelve stories high, and besides spacious headquarters for the three national engineering societies, there will be several auditoriums of various sizes, one of which will seat 1,200 to 1,500 people; an engineering museum; and a library having at the start 50,000 volumes, and which, in co-operation with the Public Library, will be the finest technical library in the world.

The three societies, each of course maintaining its identity and autonomy, will need considerable room in the new building, which it is hoped to have completed by 1906. These societies have to-day a combined membership of over 9,000, and they are growing at the rate of from 10 to 15 per cent. annually. Besides these societies, there are other technical societies having some 5,000 members engaged in all branches of civil, mechanical, electrical and municipal engineering, whom it is desired to accommodate.

THE ABRUZZI POLAR EXPEDITION.—I.*

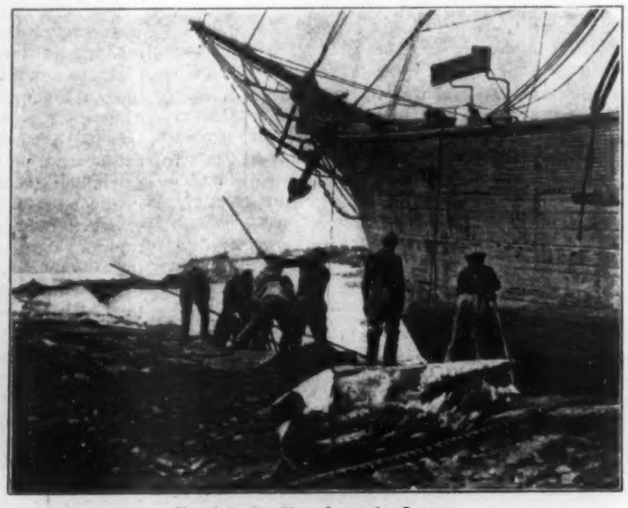
Great interest attaches to the Abruzzi polar expedition in view of the fact that it was conducted by His Royal Highness Luigi Amedeo of Savoy, Duke of the Abruzzi, and a member of the Italian royal family. The object of the expedition of the "Polar Star" was to sail as far to the north as possible along some coast line, and then to travel on sledges toward the pole, from the place where the winter had been passed. The pole was not reached by the sledge expedition, led by Commander Cagni, but he pushed on to a latitude which no man had previously attained, and proved that with determination and sturdy men and a number of well-selected dogs the frozen Arctic Ocean can actually be

(*Continued on page* 254.)

* A review of "On the 'Polar Star' in the Arctic Sea," by his Royal Highness Luigi Amedeo of Savoy, Duke of the Abruzzi. New York: Dodd, Mead & Co. 1903. Two volumes.

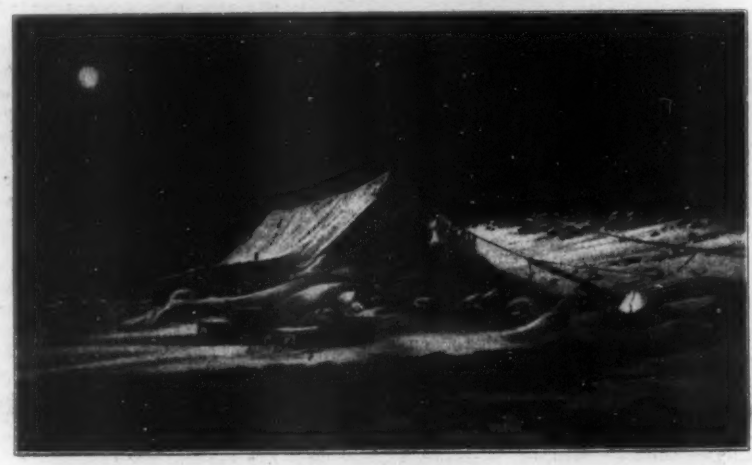
Dr. Cavalli Prepares the Rations.

Christmas Dinner.



Clearing the Ship from the Ice.

The "Polar Star" Abandoned in the Ice.



The Hut by Moonlight.

Landing the Stores While the Ship Was Nipped by the Ice.

Dragging the Kennels up on the Beach.

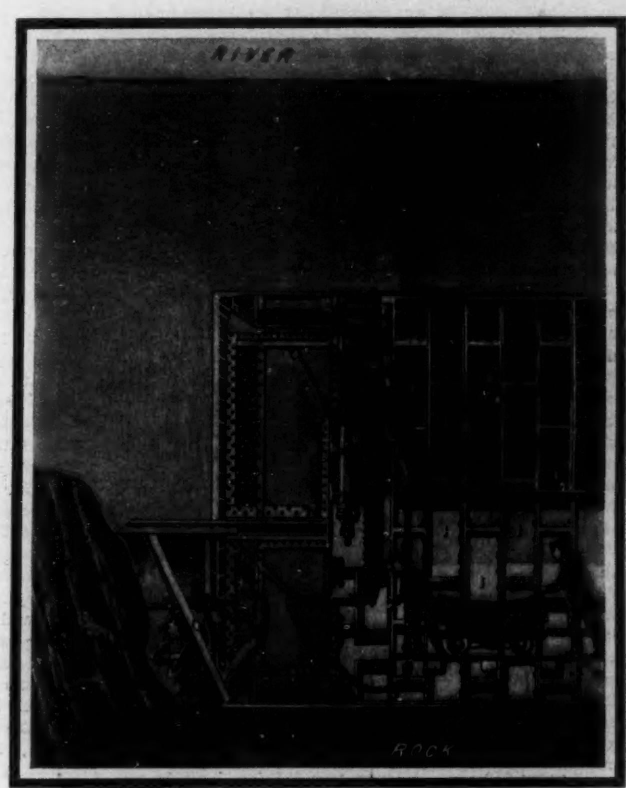
View of the Camp from the West.

THE ABRUZZI POLAR EXPEDITION.—I.

THE HUDSON RIVER TUNNEL.

March 11, 1904, marks the successful culmination of the work begun thirty years ago on the Hudson River tunnel. On that day the junction was made between the New Jersey heading and the old New York section of the north tube and Mr. William G. McAdoo, president of the New York and New Jersey Company, was accorded the honor of being the first man to pass from Jersey City to New York under the Hudson River. The progress of this tunnel from its inception up to the present time has been periodically chronicled in these columns, so that our readers will not need a lengthy account of the undertaking, but a brief *résumé* of the principal events which mark the history of this great engineering enterprise may be in order.

The original projector of the tunnel was Mr. Dewitt Clinton Haskin, under whose direction the work was begun in 1874. A shaft was sunk at Fifteenth Street, Jersey City, and at the foot of Morton Street, New York, and from the bottoms of these shafts twin tunnels were run out under the river. In carrying out this work no excavating shield was used, as it was thought that the silt was sufficiently compact to hold its position until the two-foot brick lining was set in place. This surmise proved incorrect, and it was found necessary to use a five-foot pilot tube, which was pushed ahead of the main tunnel and used as a center for radial braces, which supported the tunnel wall under construction. The work was carried on without serious accident until in July, 1880, the shallow layer of silt between the tunnel roof and the river gave way under the pneumatic pressure in the tunnel, and the inrushing water drowned twenty of the workmen. The work was then continued half-heartedly for two years, when, with 2,000 feet of the north tunnel completed, it was abandoned. In 1890 an English company took up the work, using an excavating shield, and working from the Jersey end carried the tunnel forward to within 1,500 feet of the old New York heading. Again the work was abandoned until 1896, when the New York and New Jersey Company took charge of the work, and in 1902 began the work which has since been carried out to its present successful issue. This magnificent engineering achievement of Jacobs and Davies, engineers of the New York and New Jersey Company, in accomplishing that which had twice before been attempted and abandoned, is deserving of highest praise, particularly in view of the fact that difficulties were met and successfully overcome, which the other companies did not encounter and which, in fact, the engineering world has never before been called upon to master. The work had progressed only a few hundred feet when rock was encountered in the lower part of the tunnel. The excavating shield in use, the one that the English company had installed, was designed to be forced through silt, and it would merely have crumpled into a shapeless mass if it had been forced against this rock barrier. It was necessary, therefore, for the workmen to advance beyond the cutting edge of the shield, and blast out this rock before moving the shield forward. If the rock had covered the entire face of the shield, this would have been a comparatively easy matter; but the engineers were confronted by the unique problem of driving the floor of the tunnel through rock and the roof through silt. To meet these conditions, it was found necessary to build an apron out in front of the shield, which would protect the workmen from the silt above. This apron, as shown in one of our illustrations, extended from side to side of the tunnel shield near its center line, and projected forward about 6 feet. It was built of ¾-inch steel plates laid on brackets formed of 12-inch I-beams. This apron enabled the workmen to attack the rock without fear of being smothered by an avalanche of the soft silt above. Even with



Blasting Out Rock Under the Protecting Apron.


Junction of the Two Sections, Showing Also the Tilted Position of the Shield.


The New Shield at Morton Street, Which is to Continue the Tunnel Under the City.

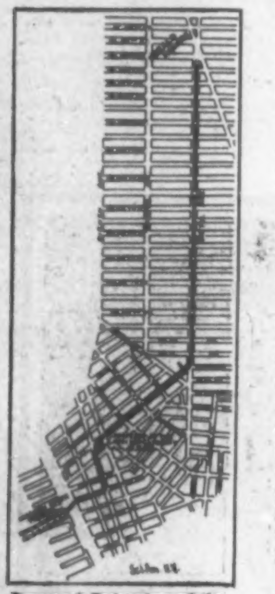

Sectional View, Showing the Course of the Tunnel Under the Hudson River.

THE HUDSON RIVER TUNNEL.

this protection the work was not without danger, as the rock varied in height from 1 to 16 feet. Fortunately, no casualties resulted, and the passage was slowly but steadily forced through the rock reef. With this danger past, the remainder of the work was comparatively simple, and the tunnel was rapidly pushed on to the New York heading.

As the work advanced, the course of the tunnel was carefully plotted out, and the excavating shield was steered by increased pressure in one or another of the hydraulic jacks, in order that it should be brought into perfect register with the brick lining of the New York heading at the point of juncture. So careful were these calculations, that when the shield met this heading, the lateral alinement was found to be almost perfect; but vertically, an error of a few inches was made. This break is temporarily sealed with blocks of wood driven into the silt above the shield, as shown in one of our photographs.

While the shield was being operated by the English company, it was noticed that instead of remaining stationary on its axis, it was gradually turning clockwise as viewed from the front. Every effort was made to stop this movement; but it continued, until now, having traversed 3,400 feet of silt, it presents the appearance illustrated, with the vertical plates lying almost horizontal. This curious action was probably due to a slight deflection of the plates in front of the diaphragm of the shield, which tended to turn the shield through an imperceptible angle every time it was jacked forward, and these slight deflections gradually accumulated until they became quite noticeable. The tunnel has an internal diameter of 18 feet 1½ inches, and is lined with cast-iron segments 1½ inches thick, braced with webs and formed with inwardly-projecting flanges, which provide means for firmly bolting the sections together. At present a pressure of 22 pounds per square inch above normal is still maintained in the greater part of the tunnel, to prevent water from seeping through the joints of the lining, which have not yet been calked up. The shield must now be dismantled, and the cast-iron sheathing or lining run out to join the brick lining of the old heading. The shell of the shield, however, cannot be removed, and will be buried behind the cast-iron lining, a final sacrifice to the work it has served so long and faithfully.



Proposed Extension of the Hudson River Tunnel.

Some further work remains to be done on this tunnel before it will be finally completed. The English company, in order to save the cost of cartage, spread the silt, as it was excavated, over the floor of the completed section, and as a consequence a large part of the tunnel on the Jersey side is more than half filled with this material, and it must all be removed before the work of laying car tracks can be commenced.

The south tunnel, which is being run parallel to the completed tunnel, is also being excavated from the New Jersey side, and is now well under way. A distance of three-quarters of a mile remains yet to be tunneled. A new shield was built for this work, and in anticipation of the difficulties encountered in the north tube, it was provided with an apron, which can be moved out in front of the shield to permit blasting out rock in front of the cutting edge.

We illustrate herewith a new shield, now in position, which will continue the north tunnel through the city under Morton Street and Ninth Avenue to Tenth Street, where the New York station is to be built. The course of this tunnel, together with the proposed extension, is shown in the accompanying map. The purpose is to continue the tunnel up Tenth Street to Sixth Avenue, and thence up to Herald Square, with intermediate stations at Greenwich, Fourteenth, Eighteenth, Twenty-third, and Twenty-eighth Streets.

These tunnels are intended only for the use of electric cars, and not, according to the popular misapprehension, for heavy railway trains. It is the opinion of the engineers that the silt foundation is too soft to permit the passage of heavy weights through the tunnel. The silt, though very compact under the weight of the water above, nevertheless has the properties of a viscous fluid, and it is feared that it would yield under the impact and weight of a heavy steam or electric locomotive. Such yielding, though but little, would place a tremendous bending strain on the cast-iron lining, above that it could bear, and ever so slight a rupture would result in dire consequences.

A combined elevator and air lock is in use at the head of the New York shaft. The elevator shaft ends in an air lock at its upper end, and the circular platform of the cage, when in its highest position, completely closes the mouth of the shaft, and forms the bottom of the air lock. As the compressed air is released from the lock, this platform is forced snugly in place, making an air-tight closure. The cable by which the elevator is suspended must, of course, pass through the top of the air lock, and to prevent leakage of the compressed air it is incased in a long stuffing box. The movement of the cable through this stuffing box is so slow as not to seriously wear the packing.

THE ABRUZZI POLAR EXPEDITION.—I.

(*Continued from page 252.*)

crossed to the highest latitude. Besides attempting to reach the highest possible latitude, the expedition was also calculated to take observations on gravitation and terrestrial magnetism, and also to enlarge our meteorological and hydrographical knowledge of the localities which were to be visited and to collect as much information as possible with regard to the flora and fauna of Franz Josef Land.

Dogs are undeniably the most useful animals for man in his Polar expeditions where sledges must be dragged over the ice of the Polar Sea. They have this advantage also, that, unlike horses and reindeer, they readily eat their fellows. Their weight is small, and they can be easily carried on light boats or on ice floes. As the Danish government has forbidden the exportation of dogs from Greenland, it was decided to bring them from Western Siberia, and an order was given in July, 1898, for one hundred and twenty dogs.

The vessel selected was a whaler about to start for the seal fishery. The "Jason" as she was called, could carry 570 tons of cargo, was 131 feet long, 30 feet 6 inches wide, and drew about 16 feet. Her engines were of 60 nominal horse power and gave a speed of from 6 to 7 miles an hour. The ship had a new boiler and carried a spare propeller and rudder. Many changes were required to be made. Stanchions were placed in the hold, the lower deck, which is movable in a sealer, was firmly fixed, the masts were changed, and the vessel was transformed from a bark to a barkentine. As the object of the expedition was to reach that spot on the surface of the earth near the zenith of which shines a star, known to all from the man of learning to the peasant, what name could have been more appropriate to the ship than "Stella Polare"? So the "Jason" became the "Polar Star." The expedition consisted of His Royal Highness the Duke of the Abruzzi, Capt. Cagni, Lieut. Querini, Dr. Molinelli, Capt. Evanson, who navigated the vessel, three officers, four Alpine guides, and eight sailors. The expedition took with it supplies for four years and a preference was given to those kinds of food which had been chosen by Nansen for the first expedition of the "Fram," and Sverdrup had chosen for the second. As much variety as possible was aimed at in the choice of the supplies, so as to avoid tiring the palate. Food was divided into cases of 55 pounds each, containing the same variety, so that the contents would be accurately known at all times. Plenty of furs, coats, and woolen garments were taken. Special attention was given to caps, gloves, gauntlets, stockings, and shoes, so that all conditions of weather could be met. Stoves, tents, sledges, dog harness and firearms were also liberally provided, and 440 pounds of gun-cotton for blasting the ice were also taken. Great care was taken in the selection of the scientific instruments. Four balloons were provided, of varying shapes. Two of them were selected for actual use in the expedition. They were packed in crates to allow the air to circulate and were placed on deck along with the apparatus for producing hydrogen gas, and a small boiler. Thirty-six iron tanks containing about twelve tons of sulphuric acid were placed in the center of the deck in an inclosure lined with lead and provided with a gutter so as to prevent the acid from burning the boards of the deck in case of leakage. Six tons of iron filings completed the aeronautical outfit.

The "Polar Star" left Christiania on June 12, 1899, and Archangel was reached on June 30, where the dogs were embarked. Two rows of cages, one above the other, were built against the bulwarks of the ship on both sides. The first row rested on the deck, the other was one yard above it, and these cages were separated by wooden partitions. Four dogs were placed in each and chained to the corners so that they could not bite each other. As the cages and their floors were covered with gratings and tarpaulin, they could be frequently washed and the dogs were kept dry. The final departure of the expedition occurred on July 12 and three days later they met ice for the first time, and on July 20, the misty outlines of Northbrook Island were sighted; the Emperor Franz Josef archipelago lay before them, and the huts left by Jackson's expedition were discerned. Provisions for eight months and five tons of coal were landed, so that in case of any misfortune to the ship which would necessitate a retreat these stores would enable the explorers to subsist until the following summer. Various observations were made and on July 26 the trip was resumed. On August 5 a vessel was sighted and there was little question that this was the "Capella." The "Polar Star" signaled to know if the Wellman expedition was on board. A launch in which a man who had the appearance of an invalid was lying, with one leg stretched out, left the "Capella" and went toward the "Polar Star." Although very dissimilar from the photographs which the Duke had seen in the newspapers, he recognized Wellman. The latter was lifted on board and he was helped into the saloon. Other members of his party accompanied him. It seems that Wellman had met with an accident shortly before arriving, so that the expedition was forced to return, as it had lost some of its provisions when pressed by the ice floes and it had reached its highest latitude near the above-mentioned island. After a few pleasant hours the two ships sailed away, the "Capella" steering southward to return to civilization, while the "Polar Star" steered for Maria Elizabeth Island. On August 7, Prince Rudolph Island was reached, the latitude being 82 deg. 4 min. The "Polar Star" thus reached with the greatest ease the Emperor Franz Josef archipelago, which in 1873 Payer had thought so difficult to approach. The expedition disembarked in the Bay of Teplitz and its members immediately set to work to prepare the winter quarters. Kennels were built for the dogs, which showed little affection and still less obedience. They fear only the whip and water; for in the intensely cold regions where they live, if they get wet, the water freezes immediately on their bodies and forms a cuirass which hinders every movement. The ice field driven by the pack closed up the channel made by the "Polar Star," heeling her over about thirteen feet. The ship was righted by means of some gun-cotton mines which had been sprung on the left side, but the vessel did not remain long in normal position, as the ice again succeeded in heeling her over. The ice field in the bay driven by the ice pack had risen all around over that which lay along the coast and had reached up to the kennels, against the door of which some large floes had been piled up, thus preventing egress. When the dogs gave the alarm the crew ran to extricate them by breaking the inner partitions and letting them out on the side of the land. The vessel had also sprung a leak. There was grave danger that if the ice gave way the boat would sink, and, therefore, they were obliged to land with the utmost haste the stores for winter, and to secure the necessary materials for building a dwelling house. The outlook of a winter passed in this bay, with but scanty resources, and of a retreat to be carried out with still more scanty resources in the following spring, was gloomy. It was hard to work on board as the ship heeled over so much and the deck was covered with ice. Disembarkation continued all that day with the exception of intervals for meals. As the ship still remained in the same situation, which had not become more dangerous, and as all that was required to pass the winter had been rescued, they began to disembark what would be wanted for the sledge expedition, so that if the vessel was lost they would still have the means of accomplishing the undertaking for which they had set out. The heeling over of the vessel had rendered life on board uncomfortable, and any further pressure of the ice might have cast her on her beam ends and obliged the expedition to abandon her completely. It was therefore decided that it was better to leave her and take up land quarters where they would be safe from any sudden danger. The expedition had been provided with two field tents which would lodge the whole crew, though they alone would not suffice to protect them during the winter, or to resist the violence of the wind, but were strengthened with additional covers, also of canvas, so as to form air spaces between them, so that a sufficiently high temperature could be kept up inside, and, if the outer covering were made of stronger sail cloth, it would be able to resist the wind. The canvas awning which had stood on the deck, with the poles and cross-bars which formed its framework, was well suited to stand over the field tents. With the spars and the sails of the ship the third tent was constructed which covered the others. (*To be concluded.*)

Newton's law of gravitation, which states that two bodies attract each other with a force inversely proportional to the square of the distance between them, has been made the subject of an exhaustive investigation by Prof. Brown, of Haverford College, says the Iron Age. He announces that his calculations show Newton's law to represent the motion of our moon to within the one-millionth part of one per cent, and states that no other physical law has ever been expressed with anything like the precision of the simple statement of this one.

Patent Department

A Bill for Establishing a Sliding Scale for Copies of Patents.

A very obnoxious bill has been reported by the House Committee on Patents, and is now before both Houses of Congress. The matter in itself is a very small one, but should this bill become a law, it will prove to be a most vexatious measure and, instead of facilitating and expediting the work of the office, it will serve to embarrass and annoy inventors, and produce a condition of affairs which is as unnecessary as it would be intolerable. The bill as presented to the House is as follows:

"Sec. 493. The price to be paid for uncertified printed copies of specifications and drawings of patents shall be determined by the Commissioner of Patents: Provided, That the maximum cost of a copy shall be ten cents for each unit of five pages, or fraction thereof, contained in the specification and drawing of such printed copy."

We cannot but feel that this measure providing for a sliding scale of cost savors of a petty and useless economy, which should not for a moment be considered by Congress. Instead of interposing vexatious conditions, every facility should be afforded inventors and attorneys for procuring copies of patents with the greatest possible ease and dispatch.

Copies of patents are now furnished at the general rate of five cents each. The Commissioner claims, however, that a few patents are very diffuse, and show an immense number of sheets of specifications and drawings, ranging sometimes from 50 to 200 pages, and that the price of five cents does not cover the cost of publishing patents of this size. This may be perfectly true, but on the great majority of patents there should be a good margin of profit to the Patent Office. For example, we have taken at random one hundred copies of patents which have recently come to hand; estimating the value of the paper at five cents a pound, which is more than liberal, we find that the cost of the paper for the one hundred copies comes to 19 cents, or in short, that the cost of the paper, per copy, averages less than two mills. It would seem that the printing should not much exceed the cost of the paper; in fact, a local printer has estimated the cost of the mere printing and paper, not including the original cost of plates, at about one and a half cents a copy. It is apparent, therefore, from this, that the average profit on the ordinary run of patent copies should far more than make up the loss on the few patents of excessive size which are issued.

Even if this department were run at a loss, which has been questioned by the Patent Law Association of Washington, which has begun a campaign against the bill, certainly the outlay on the part of the Patent Office is well expended, owing to the facilities which are offered and which should be offered to the inventors throughout the country. Attorneys throughout the land are perfectly familiar with the difficulties and delays now arising from the narrow policy already pursued by the Patent Office with reference to patent copies. Only 75 copies of each patent are printed. Of this number 35 are sent abroad for distribution among foreign patent offices and libraries. This leaves a supply of only 40 copies for distribution throughout this great and glorious land. The inventor himself can only procure 10 copies of his own patent at one time. The supply of copies is constantly running out, and attorneys and inventors are being constantly subjected to annoyance and delay incident to waiting upon the pleasure of the Patent Office to print new copies, or else they are obliged to have made hand copies, which are quite expensive.

The proposed introduction of a sliding scale of cost is quite out of the question in a great institution like the United States Patent Office. This system has been tried in England and has been abandoned as impracticable. In case the inventor writes to an attorney ordering a number of copies distributed through different classes, it would be necessary, first, for the attorney to send a clerk to the Patent Office, have a search made through the records, count the pages in each patent ordered, form an estimate of the extra cost of such patents as may have more than five pages, write back to the inventor informing him of the amount of the charge, and after all this work has been accomplished, has there been any saving to the Patent Office? No. A large force of clerks would be required in the Patent Office, to ascertain the cost of copies ordered and answer the many inquiries of attorneys all over the country. Such an expense would greatly add to the cost of obtaining the copies, and it is not readily seen how the income of the Patent Office would be greatly, if at all, increased by such a vexatious system. Considering that the United States Patent Office turned into the Treasury last year a surplus of $193,556, the necessity for such niggardliness as is shown in the proposed bill seems utterly inexplicable.

The Patent Office can well afford to bear a loss of several thousand dollars a year, were such an amount necessary, rather than subject the inventor and the public to such an annoyance. If Congress feels that the Patent Office should not be allowed the use of its own income, let it increase the price of copies from five to ten cents each; but let us have one uniform rate for all copies ordered, and let an adequate supply be printed every week, so that the delays, annoyances, and medieval methods now in vogue may be done away with.

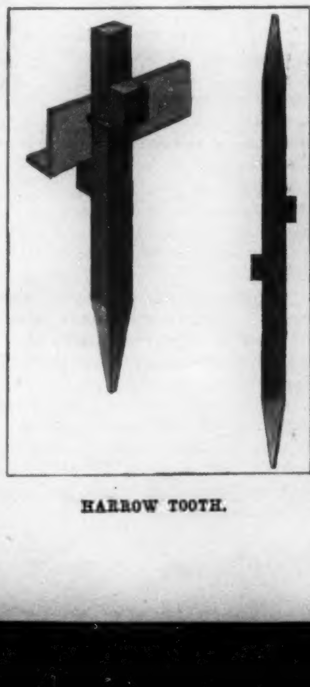
COMBINATION LOCK FOR UMBRELLAS.

In order to prevent the misappropriation of umbrellas, whether intentional or otherwise, Dr. R. B. Waite, of Springville, N. Y., has provided a device which will increase the spring latch of an umbrella, to prevent the umbrella being opened by an unauthorized person. The device is provided with a simple combination lock, which will render it impossible for anyone not familiar with the proper combination to operate the latch. The lock is so arranged that the owner can open it in the dark, the proper combination being recognized by a number of clicking sounds produced when the lock is being operated. As shown in our illustration, the device consists of a casing which, at its lower end, fits snugly onto the runner sleeve of the umbrella, but is formed with an enlarged portion which covers the spring latch. A number of disks are held in the upper end of this casing, between an indented shoulder formed therein and a cap which is soldered to the top. A keyway is cut in each of these disks, and it is only by turning these disks until they are all brought into alinement with the key formed on the runner sleeve, that the casing can be pushed upward. The disks are brought into position by turning the casing a certain distance in one direction, and then a certain distance in the opposite direction, these distances being indicated in each case by a predetermined number of clicks, due to a spring pawl formed on the upper end of the casing slipping into notches formed on one of the disks. Our illustration shows the disks in the alined position, and the casing partly moved upward. It is evident that further upward movement of the casing would result in pressing down the spring latch, thus releasing the runner sleeve from engagement therewith, and permitting the umbrella to be raised.

COMBINATION LOCK FOR UMBRELLAS.

HARROW TOOTH AND SIMPLE FASTENING DEVICE.

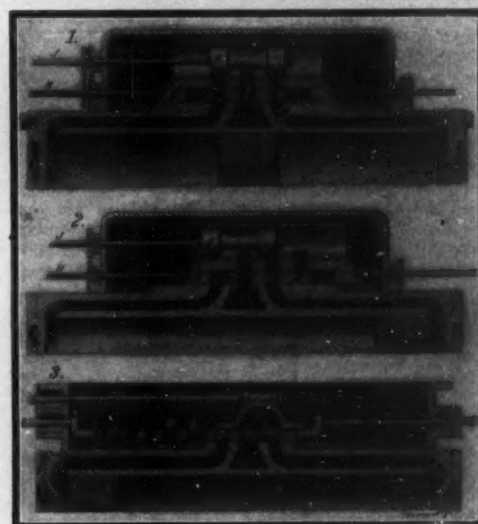
The harrow tooth which is illustrated herewith is adapted for convenient attachment upon a frame beam of a harrow, and its construction, which is extremely simple, is such as to prevent movement of the tooth in any direction while, at the same time, permitting it to be readily detached when desired. In the case of a double-pointed tooth the construction also permits the tooth to be readily reversed in position, thus substituting a sharp end of the tooth for one that is worn out. The shank or body of the tooth is formed with two lugs, that project from opposite faces of the tooth. The lower lug is adapted to fit under the angle-iron frame of the harrow, and the upper lug rests on the fastening device. This fastening device or clamp consists of a U-shaped member, whose ends pass through perforations in the vertical flange of the angle iron. When the clamp is adjusted, it is permanently secured in place by means of nuts threaded on to these ends, and bearing against the rear face of the vertical flange. At the right in the illustration, we show a tooth pointed at both ends, and it will be evident at a glance that this tooth may be applied as readily with either point in the downward or operative position. This same construction may be advantageously applied to secure cultivator teeth to the frame beam of a cultivator. A patent for this invention has recently been granted to Mr. John Y. Cooper, Rural Route No. 5, Nashville, Tenn.



HARROW TOOTH.

VALVE MECHANISM FOR LOCOMOTIVES.

We illustrate herewith a new valve mechanism for locomotives, which when the locomotive is starting and climbing grades may be operated by the engineer, to admit steam in the usual manner at both ends of the cylinders, but when running or traveling downgrade can be operated to admit steam only at the forward or at the rear ends of the cylinders. Mr. Martin Schilde, 432 Philip Street, New Orleans, La., is the inventor of this valve mechanism. The accompanying engraving shows in section two forms of Mr. Schilde's invention. The cylinder is provided with the usual steam admission ports *D* and *E*, and the exhaust port *L*, and in Figs. 1 and 2 these communicate through ports in a plate *G* with the valve cylinder of the valve *F*, which is connected by the valve stem *J* with the link movement in the usual manner. The plate *G* is secured to the bottom of the valve cylinder, and by means of the rod *H*, which leads to the engineer's cab, may be moved to any desired position over

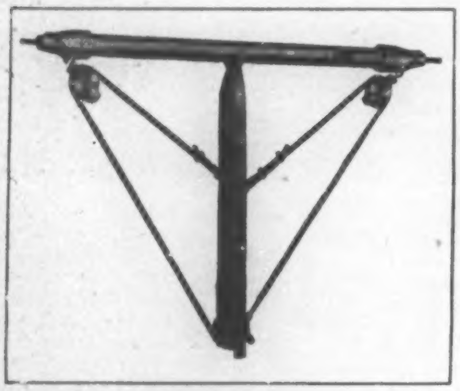


VALVE MECHANISM FOR LOCOMOTIVES.

the ports of the main or piston cylinder. With the plate in its central position, as shown in Fig. 1, steam will be admitted to the cylinder at either end. When the valve *F* moves to the right, steam enters the cylinder at the left end through ports *A* and *D*, at the same time the left end of the piston cylinder is opened through ports *E* and *B* to the valve cylinder, and thence through ports *C* to the outlet port *L*. When the valve *F* is moved to the left, the conditions are reversed. Steam enters the cylinder through ports *B* and *E*, and the exhaust passes out through ports *D*, *A* and *C* to *L*. When it is desired to admit steam only to the forward end of the piston cylinder, the plate *G* is moved to the position shown in Fig. 2, when the port *D* is always in communication with the exhaust port *L* through port *A*. Now, when the piston is moved to the left, the port *C* is uncovered, permitting steam to flow through *E* into the cylinder; and when it is moved to the right, the steam is permitted to escape through ports *E*, *C* and *A* to the exhaust port *L*. It will be readily understood that when the plate *G* is moved so as to bring the port *C* into register with port *D*, the action will be reversed, steam being admitted at the left end of the cylinder only. In Fig. 3 we show a modification of the construction, as adapted for use with a slide valve. With the parts in the position illustrated, port *E* is always in communication with the exhaust *L*, through port *P*, and port *D* connects first with the steam chest through port *O*, and then with the exhaust port *L* by way of the cavity in the valve *K* and the port *P*. Steam would be admitted to either end of the cylinder alternately if ports *O*, *N* and *M* were brought into register respectively with ports *E*, *L* and *D*. In order to admit steam to port *E* only, the plate would have to be moved to the right until port *M* registered with port *E*, when port *D* would be connected with the exhaust through port *R*.

BENDING DEVICE.

The accompanying illustration shows a portable bending device for bending wrought-iron and steel pipes, such as are used for conveying gas, water, steam, and the like. The bending device is very simple, and can be easily operated, and owing to its portability it will be found very useful for bending pipes along the route of a pipe line. The device comprises a beam, formed at one end with a fork adapted to fit over the pipe which is to be bent. Conical plugs are removably secured to each end of this pipe, and these plugs are engaged by loops, which afford a means for attaching

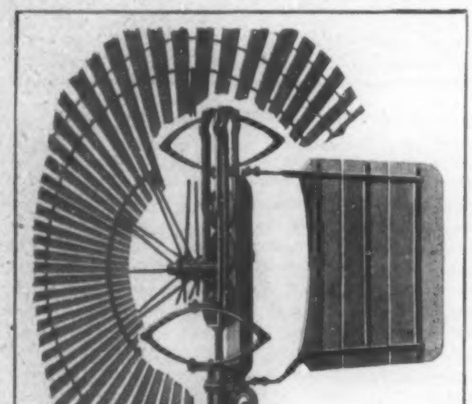


BENDING DEVICE.

a pair of sheaves thereto. The cable passes over these sheaves, and also over a sheave secured to the lower end of the beam. The two ends of this cable are hooked over a horn formed on the upper end of a rack, which is slidably mounted on the beam. At its lower end this rack is held in a frame, which also carries a lever device, by which the rack may be moved downward, exerting a pull on the cable to bend the pipe until the desired curvature has been reached. In our illustration the right-hand end of the pipe is broken away to show the form of the plug used. It will be observed that aside from being formed with a projecting pin, which closely fits into the bore of the pipe, the plug is also provided with a sleeve, which fits snugly over the exterior of the pipe. This prevents the end of the pipe from losing its shape during the bending operation. The inventor of this bending device is Mr. Theodore Damm, care R. H. Smith, 606 Pennsylvania Avenue, West, Warren, Pa.

IMPROVED WINDMILL.

A patent has recently been granted to Mr. J. G. Benzter, of 910 Railroad Avenue, Moline, Ill., for a

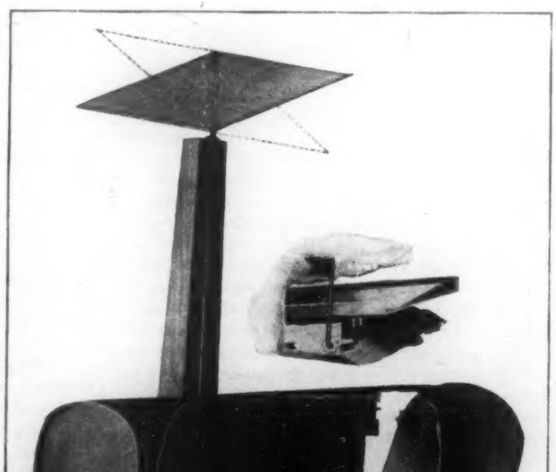


IMPROVED WINDMILL.

windmill of improved construction, which is designed to insure a direct and full transmission of the power developed in the wheel. The construction of the windmill is clearly shown in the accompanying engraving, in which the windwheel is partly broken away to show details. The frame of the windwheel is mounted to rotate on the upper end of a hollow mast. A horizontal stud projects from the frame, and on this the hub of the windwheel rotates. An eccentric disk formed on the inner end of this hub has peripheral engagement at the top and bottom, with friction rollers journaled in a vertically movable yoke. This yoke is secured to the top of the pump rod, which passes down through the hollow mast. Two elliptical springs hold the friction rollers in engagement with the eccentric, so that when the windwheel rotates, a reciprocating movement is imparted to the pump rod. The vane which holds the wheel to the wind is journaled to the frame of the windwheel, and on the lower hub a segmental bevel gear is formed, which engages a similar gear segment mounted on a stud projecting from the windwheel frame. A weighted arm, which extends from the hub of the latter segment, normally holds these segments in such position that the vane lies at a right angle to the windwheel. Means for throwing the windwheel out of the wind are provided in a segmental spur gear, also formed on the hub of the weighted bevel-gear segment, which engages the teeth of a rack. This rack can be drawn down by means of two depending rods, thus rotating the gear wheels and shifting the vane to idle position; that is, to position parallel with the plane of the windwheel. The wings or sails of the windwheel are formed of wood, and are held in place by two concentric metal rings, which are slotted to receive these wings. The rings are supported by spokes from the central hub. In forming the slots in the rings, the metal is struck up to form flanges, which are bent around the wings and hold them firmly in place. By means of this simple construction it is possible to readily replace an injured wing with a new one whenever desired without taking the rest of the wheel apart.

MAIL BOX FOR RURAL FREE DELIVERY ROUTES.

A mail box which is particularly adapted to meet requirements that have arisen in connection with the rural free delivery system has recently been invented by Mr. Howard G. Leffingwell, of Severy, Kan. It will, of course, be understood that in rural delivery systems the mail boxes are placed along the delivery routes, which in many cases are some distance away from the houses of the owners. This box is, therefore, provided with means for automatically indicating to the box owner that mail has been deposited in the box by the postman, and to the postman that mail has been deposited in the box by the owner for collection. As shown in the illustration, a balanced platform is placed in the bottom of the box, and this is connected by a rod to one end of a lever pivoted near the top of this box. The other end of the lever normally lies just below a lug formed on the door of the mail box. When mail is placed in the box, its weight depresses the platform, thereby raising the outer end of the lever, so that it encounters this lug when the door is closed, and the lever is thus bodily pushed backward. The lever, it will be observed, is pivoted to a crank secured to a rod, which at its upper end carries a semaphore, and thus when the lever is forced backward, the rod is turned on its axis, swinging the semaphore to the position which indicates the presence of mail in a box. When the owner opens the door, the semaphore, under action of a spiral spring on the rod, swings back to normal position, and on removal of the mail the platform rises, permitting the outer end of the lever to drop, so that when the door is closed again, the lug will not strike the lever, but will pass over it. When the owner deposits mail in the box, he raises a crank at the side of the mail box. This operates to support the end of the platform, as shown in our small detail view, and prevents it from tilting, under the weight of the mail deposited thereon, so that when the door is closed the semaphore is not set. A signal is secured to the outer end of the crank, so that when raised, it will attract the attention of the postman, and notify him that mail has been deposited in the box for collection.



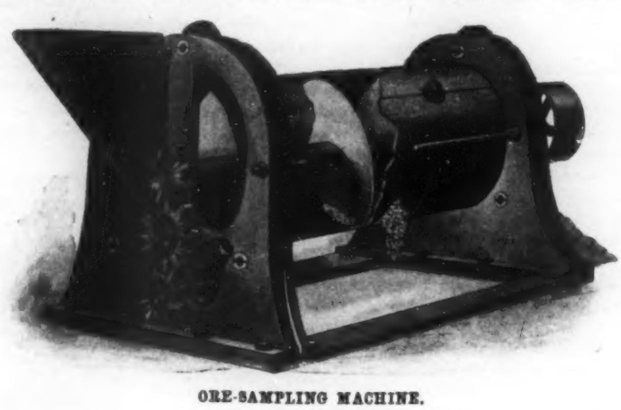
MAIL BOX FOR RURAL FREE DELIVERY ROUTES.

Transfer of the Bottle Industry.

There is every indication that the center of the glass-blowing industry has been shifted from the vicinity of Pittsburg, Pa., to Toledo, Ohio. This is a revolution which has been brought about by the general introduction of the bottle-blowing machinery. The Owens Company, which was organized to exploit valuable patents on machinery of this character, and which has its headquarters in the latter city, has, or is about to acquire the rights of its most formidable rivals, and the prospects are that the bottle-blowing industry of this country will be controlled, at an early date, by this company. The Flint Glass Workers' Association, which has for many years been located in Pittsburg, has moved its offices to Toledo. This necessitated the transferral of about $150,000, the funds of the association which had been deposited with local institutions.

ORE-SAMPLING MACHINE.

The richness of mineral ores varies so greatly, that in order to make a correct valuation of a quantity of ore, it is necessary that the sample which is to be assayed should represent an average quality of that entire quantity. This average quality is obtained by means of mechanism, which thoroughly mixes the ore and separates a certain percentage of the material, which passes through it for sample. We illustrate herewith an improved ore-sampling machine, which is the invention of Mr. William L. Raht, of 140 West North Temple Street, Salt Lake City, Utah. Many ad-



ORE-SAMPLING MACHINE.

vantages are claimed from this machine. It can be easily inspected and cleaned. It does away with elevators, which are hard to clean and expensive to operate. The correctness of the sample is not jeopardized by slipping of belts, and it does not catch the sample while the ore is dropping. This latter advantage is quite important, as it entirely obviates an objection common to some constructions, in which large pieces properly belonging to the sample, strike the edge of the opening and bound off. Mr. Raht's machine consists of a cylinder, which is mounted in roller bearings at each end. A gear ring is secured to one end of the cylinder, and this is connected by a suitable train of gearing with a power-driven screw conveyer, which passes axially through the center of the cylinder. The gearing is so arranged that the conveyer and the cylinder will rotate in opposite directions. These two movements combine to thoroughly mix the ore as it is fed forward by the conveyer. An opening of any suitable size is cut in the wall of the cylinder at the point near the discharge end. Every time this opening is rotated to its lowest position, the material overlying it drops through as a sample, while the remainder passes on and is discharged at the end of the cylinder. It will be observed that by this construction a certain constant percentage of ore, which depends on the size of the opening, will be constantly delivered as sample. One-half of the cylinder, that in which this opening is formed, is removable to permit of cleaning the interior of the machine. This section can also be replaced whenever desired by another containing a smaller or larger opening, thus affording a simple means for changing the percentage of the ore chosen for sample.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

ELECTRIC SIGNAL.—J. E. FELLER, Brooklyn, N. Y. In this case the invention relates to electric signals suitable for general use, and more particularly to a type of instrument in which the person signaled may indicate to the person signaling if the signal is properly received. It may be used in various relations, for instance, to advantage in hotels and in connection with block-signals of railways.

Household Utilities.

BED OR CUSHION.—B. T. MILLIKEN, Epperson, Ky. The invention relates to sectional beds and cushions to be made up by uniting and combining independent sections. One object is to provide an article so constructed as to allow its parts to be readily united or separated, thereby facilitating handling, repairing, and cleaning, as well as providing for extension or contraction in respect to length as different conditions of use may require. Improved ventilation is secured.

PLATE-LIFTER.—G. S. SOLOMON, Bisbee, Arizona Ter. In carrying out this invention, Mr. Solomon has in view the provision of a device exceedingly simple and durable in its construction and very positive in its operation, the device being so made that when the pan is grasped by the lifter such pan cannot turn or fall from the gripping-jaws and thereby spill the contents thereof. It may be adjusted to utensils of various dimensions or size.

Machines and Mechanical Devices.

TYPE-WRITING MACHINE.—F. S. ROSE, Newark, N. J. In this patent the invention refers to improvements in type-writers, in which is sought the production of a construction of the support or carriage for the type-platen or cylindrical roller which enables the same to be folded into compact relation to the keyboard, thus making provision for ready and convenient transportation of the instrument. Means are provided for shifting the platen relatively to the point of impact of the type-faces on the type-levers.

WOOL BURRING AND PICKING MACHINE.—G. PROUVOT, Roubaix, Department of Nord, France. This mechanism cleans locks of wool from vegetable burrs, dirt, and other refuse which may be entangled therewith. It combs the locks of wool in order to loosen the fibers or filaments and to bring them into parallel relation, thus opening the locks and spreading out and loosening the fibers, so that they are thoroughly cleaned without unnecessary straining or tearing.

Metallurgical Improvements.

ROASTING-FURNACE.—S. D. CRAIG, G. E. KELLY, and W. TURNER, Laharpe, Kan. In this instance the invention has reference to improvements in ore-roasting furnaces or kilns, and the object of the inventors is to provide a furnace in which ores may be rapidly and thoroughly roasted while being agitated by an automatically controlled device.

Of General Interest.

COMBINED SWING AND FAN.—D. W. BASH, Buda, Ill. The invention relates to a class of swings that are adapted to actuate a fan, and has for its object to provide a device of the class mentioned with novel details of construction which adapt the fan-blast to blow directly upon the occupants of the swing while the latter is in motion. It may be placed indoors for winter use, but more generally employed for exercise and amusement during summer on a lawn for adults and children.

MONKEY-WRENCH.—E. A. RENOUF, Wellsville, Ohio. In the present invention the improvement is in monkey-wrenches, and Mr. Renouf has for an object the provision of novel constuctions for securing the movable jaw and for use in adjusting or moving the said jaw along the toothed wrench-bar. The device is simple and easily applied to use.

ENVELOP.—P. DAVALOS, Havana, Cuba. The purpose of this improvement is to provide means for facilitating opening envelops, wrappers, etc., particularly those covers which are used on mail matters. This end Mr. Davalos attains by forming a tearing strip of the material of which the envelop itself is formed, thus not only cheapening the production of the self-opening envelop in cost of material, but also in labor necessary in constructing it.

NECKWEAR.—C. BARSON, Gloucester, Mass. The object in this instance is to provide a tip for necktie neckbands which will automatically lock itself in adjusted position, dispensing entirely with the ordinary retaining-pin, and to so construct such a tip that it will be not only simple, durable, and economic, but which may be threaded through the tie in the usual manner, expanding to retain its position the moment it is released in adjustment.

OPTOMETER.—W. J. LAUGHLIN, Waunakee, Wis. The object of this invention is to provide an improved optometer arranged to enable the optician to readily adjust the lenses to any desired power, for conveniently and quickly determining the visual powers and the pupilary distance of the eyes of the patient, for the selection of proper eyeglasses, and for obtaining the height and inclination of the bridge.

MEAT-PRESS.—G. FREYSLEBEN, San Diego, Cal. In this patent the invention relates to meat-presses; and it consists in providing a press of this character with hinged sides and ends, detachable corners, and compressing means, all of simple and novel construction. It enjoys special advantage in the facility with which means are adapted, affording free access to the compressed meat.

FASTENING AND SUSPENSION DEVICE.—E. M. LEWIS, Moundsville, W. Va. Heretofore when a person decorating desired to use letters, figures, emblems, shields, etc., they had to be made for the occasion. This invention obviates such difficulties by providing a device which may be suitably secured to various aticles made of paper, cardboard, cloth, metal, wood, china, glass, celluloid, candy, etc., or from a combination of any of these whereby they may be quickly attached to and removed from various objects, principally for decorative purposes.

CRACKER-CASE.—W. T. MAGNESS, Spartanburg, S. C. By this improvement the inventor provides in a case a framing provided with guides in which slide the shelves for supporting cracker-boxes, so the shelves can be adjusted out of the frame to permit access to the boxes and can be adjusted back in their guides to carry the cracker-boxes into the frame when storing the same. In connection with the sliding box-supporting shelves, lock devices secure the shelves in position and jointed links connect the outer ends of the sliding shelves with the casing to aid in guiding the movements of the shelves and to support the same when adjusted to their outer positions.

POWDER-CONTAINER.—JEANIE McC. McINTYRE, Jersey City, N. J. In this device the required quantity of powder is automatically, mechanically, and accurately measured from the container through an orifice in the container into a drawer movable in the container's exterior, in such a manner as to prevent contact of the drawer or any exterior portion of the device with the powder inside of the container. The powder always closes the orifice though which it passes by its own gravity into the exterior movable drawer, thus sealing the interior of the container from all exterior influences and preserving the flavor, fragrance, and freshness of the tooth or similar powder.

PIPE-COVERING.—M. SULLIVAN, New York, N. Y. The covering is intended to be applied paticularly to joints between pipes which themselves have a non-conducting covering, and comprises a sectional frame arranged to be clamped on the pipe-sections and to inclose the joint or connection, this frame supporting a gauze or foraminated shield which itself carries the asbestos or other compound forming the non-conducting covering.

SHIRT-WAIST HOLDER AND SKIRT-SUPPORTER.—A. WILTSEY, New York, N. Y. The purpose in this case is to provide a device adapted to hold a shirt-waist or a dress-waist down and to simultaneously hold the skirt from sagging at the back portion of the waist-band and to so construct the device that it will be capable of convenient and expeditious application and worn without discomfort. The invention improves upon the construction of a similar device for which application for patent was made in a former serial and allowed to Mr. Wiltsey.

DOOR-SECURER.—F. E. WIESNER, Washington, D. C. The invention has for an object the provision of a construction which can be easily applied and readily folded when not in use into compact form for carrying in the pocket. The device consists of a shank, with teeth formed thereon, which when the door is closed are forced into the jamb of the door. A cross bar can be slipped through a slot in this shank against the face of the door, thus locking it.

PARCEL-ATTACHING DEVICE.—H. F. ROLL, St. Louis, Mo. One of the principal objects of this invention is to devise a retaining means attachable to the person or some part of the clothing and to which device an article, such as an umbrella, is secured, so that if it should happen that the user of the retainer should attempt to leave a car without picking up the parcel he or she would be reminded by a slight jerk or pull from the retainer. It is useful for old and young for holding napkins, scissors, etc., controlling suspenders, and many other operations, but is especially for use by ladies when they go shopping or when riding in street and other cars.

CLOTHES-LINE HOLDER.—G. H. DE VINE and A. BAUMANN, Jersey City, N. J. The purpose of the inventors is the provision of a holder capable of being readily placed in position for use and of being operated from the interior of the room when the clothes are placed on the line or are removed therefrom. After clothes have been placed upon the line the device and that portion of the line supported thereby can be swung out from the room and will be held in outer position by the weight of clothes on the line.

MINER'S TOOL.—A. V. DES MOINEAUX, Silverplume, Col. This invention relates to a tool for use by miners in preparing a blasting-fuse for service; and the subject-matter of this application is in part a division of a prior one filed by Mr. Des Moineaux. The object is to provide a tool with means for splitting the end of a fuse and with a guide by which the fuse may be presented properly to the slitting devices and also held firmly in place during the slitting operation.

WOVEN PILE FABRIC.—H. SARAFIAN, Yonkers, N. Y. In this case the purpose is to provide a fabric in which the pile is exceedingly close, to give a fine appearance to the finished product, to produce an exceedingly strong and durable weave in which the piles are not liable to become loose or pull out when using the fabric as a rug, for instance, the fabric practically not showing weft or ground warp on either face, but only the pile on the face and the pile-loops on the back.

HELMET.—J. J. CURTIS, Jersey City, N. J. As is well known, the helmets ordinarily worn by policemen, firemen, and similar officials are objectionable, especially in warm weather, on account of the weight, and difficulty in ventilating to attain coolness and comfort. Mr. Curtis overcomes these difficulties. He gains an especial advantage in stiffening the brim with aluminium in that the helmet may be made of straw or any light flimsy material, a thing heretofore impossible, on account of the difficulty of stiffening the brim sufficiently.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. In every case it is necessary to give the number of the inquiry.

MUNN & CO.

Inquiry No. 5285.—For a machine to pick sponges in small pieces without cutting them.

Inquiry No. 5286.—For manufacturers of cheap toys and games.

Inquiry No. 5287.—For makers of castings for gasoline engines ¾ to 1 h. p., suitable for amateurs' use.

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Inquiry No. 5289.—For makers of machinery to make stove pipe.

Inquiry No. 5290.—For machines for preparing cotton for surgical dressing.

Inquiry No. 5291.—For machines for making pens and pen holders.

Inquiry No. 5292.—For information regarding cost, etc., of small ice-making machinery, capacity of plant 500 pounds in 5 hours' run.

Inquiry No. 5293.—For parties engaged in the manufacture and installation of electric light plants.

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Inquiry No. 5295.—For makers of steel tanks to hold 25 cubic feet to stand 600 pounds' test and high pressure pumps to pump 300 pounds.

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Inquiry No. 5300.—For manufacturers of buckram wire used in manufacturing hat frames.

Inquiry No. 5301.—For makers of gasoline or hot air engines of about ½ h. p.

Inquiry No. 5302.—For makers of small steam engine cylinders of the slide valve type of about 1½ inches stroke and ¾-inch bore, either metal or brass.

Inquiry No. 5303.—For a machine for printing on lead pencils.

Inquiry No. 5304.—For a Taylor calculating machine.

Inquiry No. 5305.—For makers of level glasses.

Inquiry No. 5306.—For makers of lathes, planers, drill presses, gasoline engine castings and automobile parts.

Inquiry No. 5307.—For a machine for imparting power to churn dashers, washing machines, also makers of corn-husking machines operated by hand.

Inquiry No. 5308.—For makers of dish-washing machines.

Inquiry No. 5309.—For makers of typewriters ranging in prices from $35 to $60.

Inquiry No. 5310.—For makers of handles for rakes, forks, etc.

Inquiry No. 5311.—For a covered automobile carrying 12 to 14 persons.

Inquiry No. 5312.—For broom-making machinery.

Inquiry No. 5313.—For a small model ¼ h. p. steam engine boiler for demonstrating purposes.

Inquiry No. 5314.—For makers of papier maché toys.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9331) **F. S. says:** Could you give us a remedy for our gas-engine igniter points? Sometimes we try and start our engine as many as ten times before we get an explosion, and all at once it goes off and everything is all right. We blame it on the igniter points; they miss the spark quite often. The make of our engine is a C——— gas engine with electric sparker. There seems to be a grease form over the points, and they get black, and then they will not spark; they are nothing but brass points. In order to get a spark again we have to take off the igniter plate and file the points. The batteries are all new. We have tried platinum points, but they break off every time. Sometimes during the day the engine stops itself because we do not get a spark. So if there is a remedy that will keep these points clean, we would like to know. We use gasoline to start our engine, which may be what causes the grease to form, but it won't start with gas. We thought that if we would make two points about ⅛ inch thick at one end, and about 3-16 inch at the other, they would make a bigger spark. Our points at present are the same thickness, about ⅛ inch thick. A. Gas engine troubles seem to be a frequent cause of complaint of late; principally due to want of knowledge of the true cause of the electric shortcoming by electric short-circuiting, of which absence of cleanliness of insulation and excess of explosive fuel are the main features of the trouble. It is not the cleaning or the filing of the points alone that is the true remedy for these troubles, but rather the thorough cleaning of the insulating surface of the ignition plug, which is the proper place to make the remedy. Grease and carbon from defective combustion deposit on the stationary insulated pole of the plug, and sometimes cause this to become short-circuited. In the event of this happening from the employment of too much lubricating oil or of a bad mixture, the igniter will not work at all until it has been removed and the insulated pole thoroughly cleaned. From your description of the trouble you experience, it would seem, however, as if the trouble were entirely due to the use of improper points. These should be neither of brass nor of platinum, but of the hard platino-iridium alloy that is specially compounded for the purpose. If the points are properly brazed on, there should be no trouble from their falling off.

(9332) **J. G. asks:** 1. When applied to a slide valve, what is meant by the term lead, and what is accomplished by same? A. The amount of opening for the admission of steam at the beginning of the stroke is called *steam lead*, and the opening for release at the end of the stroke is *exhaust lead*. The amount of the opening at dead crank center varies in ordinary engines from 1-64 to ⅛ inch valve lead, and may be as much as ¼ to ⅜ inch in special designs of valve movement. The effect is a steam compression equal to the boiler pressure at the moment of change of motion of the piston. It neutralizes the strains and effects a smoother running of the engine. 2. What is meant by the term lap, and what is accomplished by same? A. The outside lap, called the *steam lap*, is the distance the steam edge of the valve extends beyond the edge of the port when the valve is in its central position. The inside lap, called the *exhaust lap*, is the distance the valve extends or laps over the exhaust port when the valve is in its central position. The effect of outside lap is a later admission and an earlier cut-off with longer expansion. The effect of inside lap is to make the exhaust occur later and to close earlier with a longer compression. The effect of all the lead and lap combinations is for the smooth running of a steam engine, its freedom from shock or strain, and for the greatest economy in the use of steam for power. 3. What is meant by cutting off steam before piston has traveled its full stroke, and what is accomplished by same? A. The cut-off in a steam engine is the technical expression as to the point in the stroke at which the steam inlet is closed and expansion commences. By this means the power of a given volume of steam is largely increased by utilizing the decreasing pressure due to its expansion during the remainder of the stroke from the point of cut-

off, so that from the most economical points of cut-off, which for an ordinary engine may be from 15 to 30 per cent of the stroke, a saving of from 25 to 50 per cent of the power value of the steam may be made.

(9333) A. C. A. writes: In regard to note 9316, A. F. S., page 164, I think a reason why lightning is so seldom seen in winter is because the condensation is never so rapid as in summer. His own observation shows that the harder the shower, the greater display of lightning. Now to my mind the electricity is produced in the cloud in the same manner as the rain-drop, by cohesion of electrical particles in the warm air that was carried up into the colder upper air, where the condensation takes place. Now, if the rain-drop was formed by cohesion of water particles until it becomes heavy enough to fall by gravitation to the earth, why not the other? There is rain without lightning, but never lightning without rain, thus showing that lightning is the result of rapid condensation, and rain not the result of lightning, as if the electric discharge started from the top of the cloud at the same time as a drop of water, it would reach the earth first, as it travels faster. The greatest display of lightning I have ever seen was in June, 1889, when nearly ten inches of rain fell from 1.40 to 2.20 P. M., forty minutes. This was a local shower, did not rain over two miles away from my point of observation in any direction, and I think I was in the center of it. There was no wind. The cloud did not move away, but just rained down until there was only a haze left. Even this remained full five hours after the rain ceased. This cloud could not have been electrified by induction from any other, for there was none other; clear sky all about. I observed the cloud at 11.30 A. M. directly overhead, and at 12.30 P. M. it had got quite black and was larger than when first noticed. At 1 o'clock my man and I went to work in a field, half a mile from house. I told the man we were going to get wet from that cloud overhead, and we did. There were about twenty flashes of lightning before any rain reached the ground, and they were close, not over ten seconds apart. When the rain began we started for shelter, but lost all sense of direction, as the rain was so thick we could not see, and but for the lightning flashes it would have been dark as night, but the flashes were almost continuous. The rain fell straight down, no wind to drive it. I do not take any stock in the idea of electric generation by friction between two clouds, nor by friction between cloud and air currents, because the clouds do not rub each other, any more than the exhaust steam from one locomotive rubs with that of another; they mingle and become one, the instant the two engines are side by side. The cloud goes with the current of air; is not steered like a ship, in some other direction. I have never seen any one who held the same idea as myself in regard to the formation of the electricity in the clouds, and I have asked many. Also have asked people to tell me as nearly as they could the size of a streak of lightning. I saw one strike a stump at least 30 inches in diameter, and the bright streak was broader than the stump. I was about 100 feet away, and looking at the stump at the time. Another time I saw one hit a barn a mile away, and the streak was as broad as a chimney on the house beside the barn, and the chimney was 26 inches wide. I could see the streak and chimney both at the same time; the barn showed fire in half a minute. I saw one streak hit my wood pile, and it looked as large as a ¾-inch rod, and snapped like a gun cap, while there was a big crash on the opposite side of the house from me half a second later. This was a sliver from the main discharge, as I have frequently seen a flash divide into several small ones, and one when not over 100 feet from the ground, and the parts went away horizontally, while the main body was vertical. I have always watched the lightning whenever I could, and have seen some queer antics of it. A. The theory of our esteemed correspondent does not reach to the point of explaining the origin of the electricity of the atmosphere. It begins with electricity already present in the atmosphere. There is no difficulty in accounting for the rise of intensity of electrification in the thunder storm. The fact that the air is always in fair and stormy weather alike charged with electricity is more difficult to account for. We cannot follow him in the measure of the diameter of a flash of lightning. The great enlargement of a bright line of light in comparison with its real size by irradiation prevents the testimony of the eye from having much value in the case. The account of the cloudburst, as such heavy showers are commonly but erroneously called, is very interesting.

(9334) W. A. H. and others ask: Please tell me the difference between non-luminous radium and radium (luminous). I refer to the article in your paper of January 2, namely: "A Home-Made Spinthariscope." Also, how can purple stains be removed from type-keys? A. Non-luminous radium is radium of so low a potency or purity as to give no light of itself, which can be perceived even after long effort in the deepest darkness. When a mixture of such radium and pulverized willemite is examined in the dark, it is found to be luminous. The willemite is caused to glow by the radium, which does not of itself glow. This is what is meant by the home-made spinthariscope. Prices quoted on chemicals a few weeks ago cannot be relied upon now, since these substances are rising very rapidly in market value. Purple stains can be removed from type-keys with alcohol if the stains are aniline.

NEW BOOKS, ETC.

Cassell's Popular Science. Vol. I. Edited by Alexander S. Galt. Illustrated. London, Paris, New York, and Melbourne. 1903. Square 8vo.

The book which lies before us comprises a series of articles well illustrated, and for the most part excellently written, describing in simple, terse language the scientific causes of the phenomena which play an important part in our daily lives. "How the Camera Works," "Meteors," "The Wizard Electricity," "A Piece of Sponge," "How and Why a Stone Falls," "Time Told by the Sun," "What is Radium?" are a few of the more suggestive titles of these articles. Since this is but the first volume, it is hardly fair to call attention to several topics which, in our opinion, should have been discussed, since they may find a place in subsequent volumes. Among these topics we may, however, be permitted to suggest those of "Bessemer Steel," "Aerial Navigation," "the Telephone," and the "Steam Engine." The subjects which are treated in this volume, however, cover a very wide range. They include astronomy, natural history, chemistry, electricity, anatomy, and geology. Each article, so far as we have been able to judge, gives a very comprehensive view of the particular subject which it discusses. The book shows what can be done in the way of treating science popularly and yet accurately.

General Zoology. Practical, Systematic, and Comparative. Being a Revision and Rearrangement of Orton's Comparative Zoology. New York: American Book Company. N. D. 12mo. Pp. 512. Price $1.80.

The present textbook is suited to the needs of the general student, who wishes to learn the principal facts and theories of zoology, and thus to obtain a fairly comprehensive idea of the science. To this end it has seemed desirable to arrange a course of study, so that the student may gain by personal observation a concrete knowledge of the structure and activities of animals, and by so doing acquire some familiarity with the method of zoological investigation, so that he may also obtain a knowledge of the relationships of animals as expressed in an accepted scheme of classification. The laboratory exercises are well arranged, and the book is illustrated by 379 engravings, many of which are from life. We note particularly an excellent photograph of a beaver at work.

Diagrammes et Surfaces Thermodynamiques. Par J. W. Gibbs. Traduction de M. G. Roy, Chef des Travaux de Physique à l'Université de Dijon. Avec une introduction de M. B. Brunhes, Professor à l'Université de Clermont. Série Physico-Mathematique Scientia. Paris: C. Naud, éditeur. 1903. Pp. 100.

The influence exercised on contemporaneous chemistry by the ideas of Prof. Gibbs has constantly increased; and yet, even in its original English form, his work on thermo-dynamics remains comparatively inaccessible. The monograph before us is a French translation of two treatises on the geometrical representation of thermo-dynamic phenomena by means of diagrams and surfaces. The ideas of Prof. Gibbs have inspired many an interesting experiment for detecting the reactions which occur in thermic motors, by means of diagrams other than the exact figures of Clapenyron. The present work will doubtless find in France fully as welcome a reception as the original met with in English-speaking countries.

Tables and Other Data for Engineers and Business Men. Compiled by F. E. Ferris, D.S. Nashville, Tenn.: University Press. 24mo. Pp. 152. Price 50 cents.

An excellent little pocketbook adapted for the vest pocket. The tables are unusually well selected.

American Hand Book of the Brewing, Malting, and Auxiliary Trades. A Book of Ready Reference for Persons Connected with the Brewing, Malting, and Auxiliary Trades. Together with Tables, Formulas, Calculations, Bibliography, and Dictionary of Technical Terms. By Robert Wahl, Ph.D., and Max Henius, Ph.D. Second Edition. Chicago: W. C. Keener & Co. 1902. 16mo. Pp. 1,266. Price $10.

If ever a reference book represented original work, this does. Its editors had no precedent whatever to guide them. To be sure, there are books on bottom fermentation brewing as practised on the continent of Europe; but these are in German. There are books on top fermentation brewing as practised in Great Britain. But even if all these books were available to the American brewer, they would not fulfill his requirements, for the reason that he employs neither of the two systems mentioned exclusively. The American brewing industry is a thing apart. It was for the purpose of fulfilling American requirements that the present handbook was written. From an examination of its contents we are convinced that the work is all that its authors desired it to be. They have been decidedly successful in preparing a book of ready reference which the brewing, malting, and auxiliary trades will find useful.

Manual of Screw Cutting. By William Simpson. Wollaston, Mass.: Published by the Author. 18mo. Pp. 72. Price 40 cents.

This little manual deals with screws, screw cutting, and other mechanical powers. It will prove useful to all mechanics.

Graphic Statics. With Applications to Trusses, Beams, and Arches. By Jerome Sondericker, B.S., C.E. New York: John Wiley & Sons. 1903. 8vo. Pp. 137, three folding plates. Price $2.

This book is the outgrowth of an extended experience in teaching graphic statics at the Massachusetts Institute of Technology. While it deals specifically with problems encountered in building construction, it should be found serviceable to engineers and engineering students generally. As a preparation the reader should have a knowledge of statics and the strength of materials, including beam stresses and deflections, as these subjects are commonly presented. The whole matter of graphic statics is a most important one in view of our modern system of building construction, and the book before us is a most thorough and excellent treatise on the subject.

Water Supply. A Student's Handbook on the Conditions Governing the Selection of Sources and the Distribution of Water. By Reginald E. Middleton. London: Charles Griffen & Co., Ltd. Philadelphia: J. B. Lippincott Company. 1903. 8vo. Pp. 168.

This is an excellent book for engineering students, as it sets forth in a compact manner the general scientific principles on which the subject is based, and serving as an introduction to larger and more technical works. Special prominence has, therefore, been given to such questions as the quality of the water, the interpretation of analyses, the stability of masonry dams, flow of water through the pipes, and the general application of mathematics to the subject. The book will prove of interest to those for whom it was written, even though some of the practice may be at variance with that of our own country. The formulas and diagrams are particularly to be commended.

The Sugar Cane in Egypt. By Walter Tiemann. Altrincham, near Manchester, England: International Sugar Journal. 1903. 16mo. Pp. 75, 16 plates. Price $2.

The British occupation of Egypt, which dates from 1882, has been followed by remarkable progress, as the wonderful development of the agricultural interests bear witness. While the technical and mechanical conditions in the factories of the colonial sugar industry have made great strides in progress, the *materia prima*, the sugar cane itself, has in most countries remained subject to the old primitive methods of culture. The object of the present work is to outline the present methods, and to show how improvements can be made. The book contains some interesting field experiments.

The Localization of Faults in Electric Light and Power Mains. By F. Charles Raphael. London: The Electrician Printing and Publishing Company, Ltd. New York: D. Van Nostrand Company. N. D. 8vo. Pp. 205. Price $3 net.

The subject of the localization of faults in electric mains is a most important one, and it appears to have been a rather neglected part of electrical engineering. Methods are constantly changing, and the very latest are described in this second and revised edition. The author justly says that since the publication of the first edition, considerable progress has been made in the art of cable making and cable laying, and increased practice and experience have led to a nearer approach to perfection. This book should be in the hands of all practical electrical engineers.

Acetylene Gas. How to Make and Use It. By Cyril N. Turner. London: Percival Marshall & Co. N. D. 18mo. Pp. 62. Price 20 cents.

The author states that the inventor of the process was either an American, Willson, or Henri Moissan, the celebrated French chemist. We have never heard Mr. Willson's claim to the invention disputed. He certainly has everything very tangible in the patent line. This little book will prove of interest to amateurs.

General Data on Thomson Recording Wattmeters. Schenectady, N. Y.: General Electric Company. 1903. 16mo. Pp. 217.

All who are interested in selling current will be glad of the present volume. It is filled with tables and diagrams.

The Technology of Sugar. By John Geddes McIntosh. London: Scott, Greenwood & Co. New York: D. Van Nostrand Company. 1903. 8vo. Pp. 408. Price $4.50.

The British and Colonial sugar industry has been on the wane. Obsolete machinery and methods contributed much to the decadence of the industry. It has, therefore, been the aim of the author to show the most modern methods employed in this industry. There are a large number of books on sugar making, but there is ample room for the present book, which deals with the classification of sugar, beet sugar, cane sugar, sugar refining, and the selection of sugars. All who are in any way identified with the sugar industry should have a copy of this book.

The Home Mechanic. By John Wright. New York: E. P. Dutton & Co. 1903. 8vo. Pp. 435. Price $3.50 net.

The present work deals with carpentry, metal work, repairs, steam engines, and similar subjects. The practice is English, but for that reason it would prove more useful to American readers. Still, however, it is thoroughly practical, and will prove to be a very useful book in the amateur's library.

A Quarterly Issue of Smithsonian Miscellaneous Collections.

The Smithsonian Institution has commenced the publication of a Quarterly Issue of its Miscellaneous Collections, "designed chiefly to afford a medium for the early publication of the results of researches conducted by the Smithsonian Institution and its bureaus, and especially for the publication of reports of a preliminary nature." The first number of the Quarterly Issue is a double one, and contains seventeen articles, ranging in size from 1 page to 73 pages, in addition to interesting and timely notes on the activities of the Institution, its collections, etc., the whole accompanied with fifty-six plates and numerous text figures.

The scope of the journal is broad, the first issue embodying articles on Mammalogy, Astrophysics, Paleontology, Archeology, Geology, Ornithology, Ichthyology, Ethnology, etc., thus covering a considerable range of scientific subjects.

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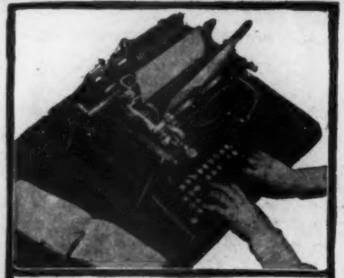
Eraser, blackboard, Seith & Kaphingst 754,900
Excavating-machine, J. D. Moran 754,480
Expansion-bolt, J. B. Gottshalk 754,764
Explosive-engine, S. S. and A. Lewis 754,466
Extensible case, E. G. Schriefer....754,814, 754,815
Fabrics, finishing, H. Bock 754,843
Farm-gate, C. P. Emery 754,758
Feed-bag, horse, J. Ratzer 754,606
Feed-water purifier, J. M. Smith 754,907
Felt-spreader, J. H. Ostrander 754,797
Fertilizer-distributer, M. L. Baker 754,408
Finger-nail buffer, C. E. Moser 754,481
Fire-alarm, automatic, M. K. Fred 754,555
Fire and water proof insulating-covering for metallic surfaces, J. A. Heany 754,868
Firearm safety device, G. A. Horne 754,564
Fireproof construction, G. Liebau 754,783
Fireproof floor construction, R. C. Kyle 754,574
Fireproof window frame and sash, I. W. Emerson 754,437
Fishing-tackle, S. Robbins 754,892
Flash-light apparatus, photographic, McColl & Klaiber 754,487
Flexible tube, S. Palmer 754,936
Flooring, roofing, etc., structural arrangement applicable to, E. L. Pease 754,888
Flue-cleaners, rotary motor for, A. Lemke 754,865
Fluid-pressure brake, Spencer & Greiner 754,908
Freezing-tank, C. W. Vollmann 754,522
Furnace. See Electric furnace.
Furnace, D. J. McKenzie 754,702
Furnace for burning tan or like fuel, D. M. Myers 754,933
Fusion, treating matters in, P. L. Hulin 754,566
Galvanic battery, reversible, T. A. Edison 754,859
Garbage-removing device, E. O. Poppe 754,890
Garment-clasp, A. J. Krienitz 754,462
Garment-stretcher, J. B. Miller 754,478
Garment-supporter, L. B. Schoch 754,813
Gas and coke, retort for making, A. C. Kloman 754,459
Gas-burner, atmospheric, A. E. Harris 754,561
Gas-burner, regenerative, J. W. McKnight 754,595
Gas-detecting means, thermostatic, J. H. Baldwin 754,534
Gas-detector, G. A. Nelson 754,598
Gas-engine, P. H. Brennan 754,418
Gas generator, acetylene, Robertson & Heap 754,808
Gas purification, apparatus for, F. Jas 754,773
Gate, H. H. Bell 754,535
Gate-opener, G. C. Laney 754,876
Gear-molding machine, F. Kepp 754,777
Gear, transmission, P. H. Brennan 754,638
Gear, variable-speed and reversing, H. R. Hevior 754,738
Gearing, differential, H. E. Bayley 754,914
Gearing, variable-speed, A. B. Shultz, et al 754,905
Glass machine, sheet, S. Deeley 754,752
Glass-working machine, I. W. Colburn 754,426

Glove-turner, G. Burr 754,539
Gold-separator, La Bud & Barton 754,657
Governor, N. Lombard 754,469
Governor, engine, H. Holzwarth 754,563
Grain-blower, G. Merkel 754,476
Grain-separator, F. M. Smith 754,617
Grain-separator, J. K. White 754,729
Grain-separator straw-rack, J. Johanneck 754,874
Grinding and polishing machine, J. B. Lobet 754,878
Grist-mill, S. L. Shelby 754,903
Guide-wheel, A. H. Mathesius 754,473
Gun, F. Novotny 754,599
Gun, automatic, C. Petersen 754,691
Gun, electromagnetic, K. Birkeland 754,637
Gun shell-ejector mechanism, F. Novotny 754,598
Gun sight, shot, P. O. Elterich 754,920
Guns, fluid-brake for recoil, E. K. Bothe 754,896
Hair-dressing device, J. T. Wilcox 754,949
Hammer, steam, C. E. Billin 754,636
Hanging basket and pot, combination, F. Neidl 754,683
Harness-rack, C. H. Mustgrove 754,483
Harvester, B. Holthaus 754,926
Harvester butt-adjuster, J. F. Steward 754,719
Harvester, corn, A. Neer 754,491
Harvester grain-deck, A. Reinhardt 754,609
Harvester-headboard, J. F. Steward 754,718
Harvester tongue-truck, E. A. Johnston 754,566
Harvester topper and stripper, cane, G. D. Luce 754,788
Hat-fastener, F. S. Boedefeld 754,916
Hat pin or fastener, Troupe & Brooks 754,519
Header and stacker, combined, J. H. Kindsvater 754,780
Heat-regulator, automatic electric, D. N. Leib 754,465
Heddle-bar fastening, Fehr & Kaufmann 754,860
Heel, adjustable shoe, A. Westwood 754,947
Hide working and unhairing machine, R. F. Whitney 754,525
Hinge, separable screen, H. B. Higgins 754,769, 754,770
Hinge, separable screen, C. Rowland 754,809, 754,810
Honey, fermenting, A. V. Kouba 754,461
Hook. See Suspension-hook.
Hook-rack, Rubicam & Baxter 754,508
Horse-rake, J. H. Randolph 754,499
Horseshoe, J. A. Martin 754,789
Hub, metal-covered vehicle, G. A. McKeel 754,490
Ice-creeper, C. F. Recknagel 754,500
Ice-tank, J. I. Hopkins 754,772
Induction-coil, R. Miller, Jr. 754,666
Ingot-crane, C. L. Taylor 754,910
Internal-combustion engine for cycles, H. Lepape 754,929
Intestine wringer, beef, H. C. Ziprick 754,630
Iron pyrites from zinc-blende, separating, K. Danziger 754,643
Ironing-table, W. O. Schellhamer 754,898
Kettles, etc., attachment for jacket, F. M. Kimball 754,779
Kiln-door, H. H. Hackerd 754,559
Labeling-machine, D. W. Kneisly 754,460
Lace holder, shoe, N. Comp 754,851
Lace or shoestring holder, shoe, B. E. R. Thomson 754,517
Ladder and scaffold support, T. Copeman 754,427
Ladder-hanger, S. C. Johnson 754,776
Lamp, J. L. Creveling 754,428
Lamp, electric pocket, A. E. Post 754,694
Lamp for canes, umbrella-sticks, etc., J. W. Allen 754,631
Lampblack-making machine, J. H. Mann 754,471
Larding or salting device, R. R. Reynolds 754,501
Latch, D. W. Tower 754,721
Lead salts, making, W. Mills 754,667
Lens-carriage-securing means, C. E. Hutchings 754,872
Letter-box, door-bell, and name-plate, combination, H. Messersmith 754,664
Leveling instrument, G. G. Townsend 754,723
Line-casting machine, W. S. Scudder 754,614
Link, separable, E. C. Vale 754,521
Lincoleum carpets, manufacturing, F. K. Magnus af Ekstrom 754,581
Linotype-machines, producing notches in linotypes or slugs as they are cast in, W. R. Speechley 754,619
Liquid-distributing system, Williams & Whitman 754,730, 754,953
Liquid-separator, centrifugal, T. H. Springer 754,909
Lister attachment, J. A. Herron 754,449
Loading apparatus, E. T. Maxwell 754,586
Locomotive-boiler, S. F. Prince, Jr. 754,497
Loom shedding apparatus, N. & J. Chaize 754,846
Loom weft-replenishing mechanism, W. H. & H. H. Hacking 754,560
Lubrication, apparatus for force-feed, J. F. McCanna 754,486
Lubricator, J. J. Aull 754,737
Mail-box carrier, G. B. Okey 754,686
Mail-carrier, F. P. O'Neill 754,795
Mail-delivery box, T. B. Gray 754,441
Map, E. Heubach 754,450
Massage device, O. Zar-Adusht-Hanish 754,925
Massage-machine, P. J. Kroll 754,463
Match-case, S. Robert 754,707
Measure, tailor's, S. M. Griffen 754,765
Measuring and weighing machine, R. L. Patterson 754,937
Metal-plate-doubling machine, B. H. Doll 754,433
Microscopes, fine adjustment for, C. F. Dieckmann 754,954
Milking-machine, Hulbert & Park 754,453
Miter-box, J. A. Traut 754,624, 754,625
Molding apparatus, R. A. Penrose 754,496
Mop-wringer, C. E. Hill 754,870
Mortising chain cutter, portable, G. A. D'Isepo 754,752
Mountain-climber, reversible, N. Laub 754,577
Mouse-trap, T. L. Ray 754,801
Mowing-machine pitman connection, F. P. Burkhardt 754,538
Music-rack, folding, J. H. Rockwell 754,502
Musical instruments, means for regulating the expression of mechanical, R. W. Pain 754,886
Nail-extractor, A. Dudly, Sr. 754,754
Nitrogen compounds from atmospheric nitrogen, making, H. Mehner 754,474
Nozzle, exhaust, W. S. Clarkson 754,746
Nut, lock, Evans & Williams 754,438
Nut-lock, J. C. Mitchell 754,590
Nut-lock, J. E. Hedrick 754,767
Oil-burner, A. Maeulen 754,661
Oil-cake-treating apparatus, A. B. Lawther 754,576
Ordnance automatic firing device, L. Ohry 754,885
Ore and pulp sampler, automatic, C. Allen 754,912
Ore and slime separator, automatic, C. Allen 754,911
Ores from magnetic gangue, separating, T. A. Edison 754,756
Organ, D. Schustek 754,713
Oven, bake, H. Heacker 754,866
Package, shipping, J. A. Bower 754,537
Packing, rod, N. H. Albrecht 754,834
Padlock, J. B. Miller 754,479
Paper-folding machine, E. D. Casterline, reissue 12,204
Pedestal, angular, C. H. Howland-Sherman 754,871
Pen, fountain, W. Bovill 754,416
Petroleum, apparatus for refining crude, J. M. O'Neall 754,687
Phonographic apparatus, Skiff & Grant 754,508
Phosphorus compound and making same, organic, S. Posternak 754,803
Photographic film, R. A. Anthony 754,736
Photographic film, flexible, F. A. Anthony 754,735
Photographic view-finder, J. A. Robertson 754,803
Piano attachment, pneumatic, R. C. Pryor 754,498
Piano-players, pedal-stop action for automatic, W. F. Cooper, Jr. 754,750
Pin. See Hat-pin.
Pipe and nut wrench, combined, J. C. Snider 754,509
Piston-rod, H. A. J. Neumann 754,793
Pitman, K. F. Seith 754,506
Plant support and holder, adjustable, H. C. Chessman 754,542
Plow, J. Khell 754,572
Post-hole digger, C. Butcher 754,421
Power machine, hand or foot, J. P. Cline 754,849
Power mechanism, interchangeable hand and motive, Elliott & Norris 754,757
Propelling apparatus, vessel, M. P. Schetnel 754,710
Pump, J. M. Crowley 754,431
Pump, heating and condensing feed, W. Tate 754,826
Pump, lubricating, McCanna & Markle 754,485
Puzzle, L. Van Putten 754,724
Pyrographic work, tool for, Z. N. Tyszowska 754,944
Rail-bender, R. O. Hintz 754,562
Rail-joint, W. Watkins 754,727
Railway cross-tie, T. J. Kitto 754,458

Railway danger-signals, electrically-operated stopping means at, W. L. Adamson 754,406
Railway, electric, Huber & Behn Eschenburg 754,565
Railway-frog, Kimball & Conners 754,875
Railway plow, electric, J. H. Akers 754,832
Railway-rail joint, A. Barnes 754,913
Railway-rails, device for preventing the creeping and wandering of, E. Masik ... 754,881
Railway-switch, T. E. Gummerson 754,864
Railway-switch, automatic, M. M. Whitfield 754,627
Railway-tie plate, W. S. Jones 754,654
Railways, automatic brake-applying device for, Meyer & Gerits 754,665
Register, H. A. Niehoff 754,684
Rheostat, L. Lyndon 754,660
Rheostat, C. R. Pitrat 754,692
Ringing and listening key, C. H. North 754,935
Roll-holder, J. Burry 754,420
Roof valleys, means for covering tile, W. Ludowici 754,578
Rope-haulage socket, G. W. Minto 754,569
Rotary engine, H. Berglund 754,411
Rotary steam-engine, H. C. Mitchell 754,672
Rule, P. S. Hamrick 754,445
Safe, R. E. Thompson 754,623
Safety-pin, A. Buckelew 754,743
Sash holder and lock, O. E. Howe 754,452
Sash, pivoted, G. Kaburek 754,655
Sash, window, G. H. Lawrence 754,575
Scenic effects, apparatus for producing, E. O. Healy 754,867
Scenographic apparatus, Austen & Bradwell 754,532
Scenographic apparatus, E. J. Austen 754,533
Scholar's companion, A. E. Greves 754,558
School companion, T. Crawford 754,852
Screen, D. D. Pinkham 754,799, 754,800
Screen hanger, half-sized, H. B. Higgins ... 754,771
Seat-spider, H. W. Bolens 754,413
Seine-hauling apparatus, H. C. Albee 754,833
Self-adjusting wheel, Root & Wallace 754,894
Semielliptic spring, T. A. Shea 754,715
Sewing machine feeding mechanism, D. Noble 754,934
Sewing machine ruffling mechanism, A. Laubscher 754,928
Shade goods, machine for trimming and applying, E. O. Engberg 754,759
Sharpener, disk, W. J. Julian 754,455
Shaving mug, I. E. Foltz 754,761
Sheet metal edging machine, E. F. Lockwood 754,786
Shelf support, adjustable, E. G. Schriefer, 754,816, 754,817
Shoe attachment, athletic, J. G. Mitchell .. 754,673
Shovel and foot protector, J. Christiansen. 754,543
Shoveling device, J. G. Westbrook 754,946
Show case, W. H. J. Guest 754,443
Show case, C. W. Seblen 754,507
Shutter worker, P. D. Marchand 754,662
Shuttle, float detecting, E. Lamoureux 754,658
Sidewalk on street crossings, J. A. Rose 754,895
Siding, sheet metal, E. G. Charlebois 754,541
Sieve, F. W. Hasch 754,865
Signaling system, wireless, H. Shoemaker. 754,904
Silt and sand separator, automatic, C. Allen 754,732
Skirt hanger, S. J. Goldsmith 754,763
Sled, coasting, W. F. Parmelee 754,887
Soldering apparatus, can, J. G. & M. O. Rehfuss 754,939
Soldering machine, can, J. G. & M. O. Rehfuss 754,699
Speaking figure, Spencer & Lynde 754,825
Spring. See Couch spring.
Stacker hoisting mechanism, J. H. Kindevater 754,781
Stacker, pneumatic, J. Henry 754,448
Steam boiler, C. B. Rearick 754,697
Steam boiler, R. W. Barton 754,837
Stock, hoisting device for live, L. W. Johnson 754,775
Stone cleaning composition and making same, P. J. Brahen 754,417
Stone, manufacture of artificial, F. W. Dunn 754,550
Stove, O. P. Greene 754,557
Stove fire box, cooking, J. Mulveny 754,482
Stove, gas, H. A. Guignon 754,651
Straw, artificial, J. H. White 754,948
Stuffing box, C. D. Shorts 754,820
Stump extractor, Wheeler & Whittle 754,524
Subcaliber attachment, W. H. Bevans 754,412
Suspenders, J. W. Burgett 754,641
Suspension hook, L. H. Torrey 754,518
Tally, progressive score, I. W. Green 754,442
Tank and heater, J. F. Bates 754,838
Tap, barrel, H. Fesenfeld 754,760
Tapping device, Smith & Pelton 754,618
Telephone receiver support, H. L. Goodwin .. 754,556
Telephonic relay or repeater, I. Kitsee 754,457
Tension device, F. W. Temple 754,516
Theater building, A. Schlechter 754,711
Threshing engine belt removing device, C. McCollor 754,488
Threshing machine, A. W. Collis 754,850
Threshing machine clover hulling attachment, C. Saylor 754,612
Tie, E. F. Priddat 754,605
Tie fastener, E. F. Priddat 754,606
Tile grinding apparatus, T. H. Mooney 754,591
Tilting bin and sample display device, A. J. West 754,522
Tire, H. G. Fiske 754,648
Tire, pneumatic, J. Dupont 754,645
Tires, machine for inserting transverse wires in solid rubber, A. E. Ellinwood 754,552
Tobacco pipe, J. Berchtold 754,840
Tool, combination, A. A. Blickle 754,739
Tool, combination, Schmidt & Iskiyan 754,812
Tool, pneumatic, C. W. Peck 754,908
Tooth cleaning implement, G. C. Bessonet. 754,841
Torch, acetylene gas, W. H. Marsh 754,472
Toy, C. A. Scadding 754,709
Toy gun, J. R. Mason 754,583
Traction engine, H. Beckwith 754,409
Transits, slope stake attachment for engineers', W. G. Russell 754,897
Transmitter, reversible, Simmons & Moore. 754,822
Trimming machine, N. M. Schuster 754,818
Trolley hook for manipulating self-loading grabs, Hoover & Mason 754,652
Trolley wheel retainer, J. A. Kilpatrick .. 754,778
Truck, C. E. Davis 754,545
Tube. See Flexible tube.
Tube cleaner, B. T. Davis 754,854
Tube scraper, R. M. Smith, et al 754,952
Tufted fabrics, apparatus for the manufacture of, G. Morton 754,883
Tug fastener, hame, A. G. Shields 754,716
Tunnel construction, J. W. Reno 754,807
Turbine, steam, E. E. F. Fagerstrom 754,439
Turbine, steam, P. J. Hedlund 754,447
Typewriter, feeding device, D. S. Dufur 754,435
Typewriting machine, A. R. Jarman 754,454
Typewriting machine, C. Gabrielson 754,922
Valve, engine, J. H. Jones 754,560
Valve for turbine engines, governor, J. H. K. McCollum 754,489
Valve gear, F. Williams 754,950
Valve gearing, steam engine, J. B. Stanwood 754,620
Valve, governor, D. J. Lyon 754,880
Valve, relief, N. Lombard 754,467
Valve, safety, N. Lombard 754,468
Valve, throttle, J. Desmond 754,547
Valve, trap, C. W. Clewell 754,747
Vehicle draft attachment, F. H. Sharp 754,902
Vehicle frame and spring construction, W. F. Richards 754,610
Vehicle or machine, wheeled, L. W. Towne. 754,722
Vehicle running gear, R. A. Moore 754,690
Vehicle, self propelled, J. C. Berube 754,635
Vehicle shaft motion, device for preventing, W. N. Cleveland 754,642
Vehicle steering device, motor, Porsche & Lohner 754,802
Vehicle storm curtain, B. S. D. S. Martin. 754,930
Vehicle top support, G. Grogan 754,650
Vehicle wheel, P. A. Sanguinetti 754,504
Vending machine, coin actuating, C. A. Smiley 754,616
Ventilator, F. J. Prochaska 754,805
Vessel sighting or observing tube, S. Lake .. 754,464
Vibrating screen, W. J. Bell 754,839
Wagon, lumber, B. F. Padget 754,601
Waist attachment and skirt supporter, combination, A. Buckelew 754,742
Wardrobe, folding, H. H. Schuster 754,613
Warping machine electric stop motion, Crocker & Dean 754,748
Washboiler fountain attachment, W. A. Mayer 754,709



Washing and bleaching, composition of matter for, T. Mellor 754,598
Washing device, clothes, C. H. Gunn 754,924
Washing machine, vessel or receptacle, W. B. Page 754,494
Watch movement winding wheels, ornamentation of exposed, O. Ohlson 754,600
Watch, stem winding, A. Anselowitz 754,407
Watch, stop, E. Philippe 754,798
Water closet, H. O. Krakow 754,573
Water closet, P. A. Allen 754,733
Water closet ventilating device, W. J. Powers 754,695
Water heater, electrical, H. M. Hill 754,451
Water tube boiler, Bossingham & Emling 754,415
Watering machine, automatic stock, S. C. Clark 754,848
Weather strip, J. S. Sengiar 754,819
Weather strip, H. Eagon 754,857
Windmill, C. H. Mikkelsen 754,477
Window, O. E. Cluss 754,425
Wires, combined guide and guard for overfeed, C. M. Zellers 754,529
Wolf trap, J. W. Sprague 754,511
Wood and the product thereof, preparing, M. Lichtenberger 754,782
Wrench. See Adjustable wrench.
Wrench, L. Trudeau 754,520
Wrench, Ash & Stewart 754,633
Wrench, J. A. Abolt 754,831
Wrest plate, E. Hilger 754,860
Wringers. See Mop wringer.
Yarn skein delivering apparatus, W. Mathesius 754,584
Yarn treating apparatus, H. Lindenberg 754,784

DESIGNS.

Book cover, W. M. Rhoads 36,850
Mantel, F. A. Broadbent 36,851
Mug, L. W. Rice 36,853
Paper knife, L. W. Rice 36,854
Pin head, hat, W. Turton 36,848
Spoons, forks, or similar articles, handle for, J. E. Straker, Jr. 36,852
Tableware, metallic border for, A. Steffin 36,849

TRADE MARKS.

Anesthetic for the painless extraction of teeth, local, H. L. Wheeler 42,240
Antiseptic emollient, Schaefer Chemical Co. 42,249
Beverage, certain named, W. H. Hutchinson & Son 42,233
Books made of textile fabric, H. S. Dean, 42,227, 42,228
Carpet sweepers, National Sweeper Co., 42,253, 42,254
Cotton piece goods, G. Willis & Co. 42,230, 42,231
Disinfectant, C. Reinschild 42,250
Fiber composition, certain named articles of, J. M. Grasser 42,257
Files and rasps, G. & H. Barnett Co. 42,256
Foods or condition powders, stock, West Coast Stock Food Co. 42,238
Furniture, certain named, Booklovers Library 42,255
Insect powders and liquid vermin exterminators, C. E. Woodruff 42,239
Jellies and preserves, fruit, G. L. Harting. 42,234
Matches, friction, Ohio Match Co. 42,232
Medicine for cure of certain named diseases, Alpoli Company 42,243
Medicine for diseases of the internal organs, G. Phipps 42,245
Medicines for cure of female complaints, Dr. Richards Dyspepsia Tablet Association .. 42,244
Oil, cotton seed, Kentucky Refining Co., 42,236, 42,237
Oysters in canned and bulk form, Toke Point Oyster Co. 42,235
Pills, Lanman & Kemp 42,241
Receptacles, certain named, Hartmann Trunk Co. 42,252
Remedy for certain named diseases, R. W. Whitlatch 42,242
Remedy for certain named diseases, cones used as a, A. J. Shilling 42,247
Remedy, pile, C. Mayné 42,246
Ropes, cords, twine fiber, twine, and binder twine, International Harvester Co. of America 42,258
Salve, C. L. Buddenbohn 42,248
Tables and appliances for playing certain named games, Knickerbocker Co. 42,251
Underwaists, children's, H. & W. Co. 42,229

LABELS.

"Cuti Balm," for a lotion, E. Reith 10,825
"Discount," for newspapers, periodicals, magazines, pamphlets, etc., S. B. Hutchinson 10,819
"Flor de Astor," for cigars, Park & Tilford 10,830
"Good Chairs," for chairs, Buckeye Chair Co. 10,839
"Lochinvar Old Highland Scotch," for whisky, New York Importation Co. 10,833
"Mapo," for syrup, D. P. Ingham 10,834
"March's Hair Health," for hair and scalp cleanser, J. G. March 10,823
"Nu-Trex Flaked Wheat Food," for cereal food, American Fine Arts Co. 10,837
"Purity Brand Condensed Milk," for condensed milk, United States Condensed Milk Co. 10,836
"Royal Iris," for cigars, American Lithographic Co. 10,828, 10,829
"Shamrock Flaxette," for handkerchiefs, Acheson Harden & Co. 10,821
"Smith's Tender Joint Shoe," for shoes, C. G. Smith 10,820
"Smoker's Teeth Powder," for tooth powder, Weaver Conger Co. 10,824
"Tarbelle Whiskey," for whisky, P. McIntyre 10,832
"The Lightning Fire Extinguisher," for fire extinguishers, Suffolk Chemical Co. 10,840
"The Magic Curler," for hair curlers, J. B. Hall 10,822
"The Merchant Prince," for cigars, A. J. Schmidt 10,827
"Three Minute Plum Pudding," for a food preparation, A. T. Knapp 10,838
"Welsh's Embro," for a liniment, Scotch Embrocation Co. 10,826
"White Star," for gin, H. Gravier 10,831
"Wyoming Condensed Milk," for condensed milk, United States Condensed Milk Co. 10,835

PRINTS.

"All Nations Use the Singer," for sewing machines, Singer Manufacturing Co. 931
"Athlophoros," for a medicine, Athlophoros Co. 927
"Bromo-Seltzer," for bromo seltzer, Emerson Drug Co. 926
"C. D. & T." for electric cars, Cincinnati, Dayton & Toledo Traction Co. 932
"Foxy Grandpa's Multiplier," for a multiplier, F. J. Smith 922
"Golden Rule Hair Restorative," for a hair restorative, Citizens Wholesale Supply Co. 929
"Non-Aqua," for shoes, O. McCormick 924
"Ozomulsion," for medicine, Ozomulsion Co. ... 928
"Pride of Reidsville," for smoking tobacco, R. Harris & Bro. 925
"The Romunder 'Comfort' Passenger Car," for passenger cars, H. Romunder 933
"The Victor Jewel Premium Machine," for talking machines and accessories, Victor Talking Machine Co. 930

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.